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BEHAVIOR OF RED SPIDER MONKEYS IN PANAMA

C. R. CARPENTER

The general purpose of the investigation described in this paper was to supplement existing knowledge of the activities and social relations of non-human primates living under natural conditions. Red spider monkeys (*Ateles geoffroyi* Kühl) were selected as good subjects for a study like the one already made of howling monkeys (Carpenter, 1934). Adequate data were sought with a view to eventual comparative work on many important types of American and Old World primates.

The observational data which are the basis of this report were collected during two encampments in the Coto Region of western Panama. A total of forty-eight days was spent in the forest. At times it was possible to make daily and almost continuous observations on groups or parts of groups of spider monkeys. The first camp lasted from June 1 to 26, 1932, and the second from February 18 to March 12, 1933. Much remains to be done before the work on spider monkeys is complete. Therefore this is a preliminary report.

The La Vaca River flows through the poorly mapped and sparsely settled Coto Region which lies on the border of Panama and Costa Rica. Along this river, toward the foot-hills, the forest is dense and is occupied by an abundance of wild life that is almost entirely unmolested by hunters. There are to be found tapirs, deer, jaguars, pumas, ocelots, tayras, peccaries, many small mammals, and a great variety of birds. In addition, there are five types of monkeys: red spider monkeys (*Ateles geoffroyi* Kühl), very plentiful—possibly more than two hundred of them occurring on every square mile; capuchin monkeys (*Cebus capucinus*), more limited in number; howling monkeys (*Alouatta palliata palliata*), few in number and rarely seen, but occasionally heard howling in the distance; squirrel monkeys (*Saimiri örstedii örstedii*), fairly plentiful in the low bush regions; and marmosets (*Oedipomidas geoffroyi*), very scarce. It was in the region of this dense, undisturbed animal population that a camp was established in 1932 and occupied again in 1933.

Dr. Herbert C. Clark of the Gorgas Memorial Institute invited the author to join an expedition into the Coto Region in 1932. Dr. Clark initiated, organized and directed that expedition. He also assisted in arranging and supplying equipment for the camp of the next year. It was possible for the writer to take advantage of the opportunities afforded him because of the approval and sponsorship of Professor Robert M. Yerkes of the Laboratories of Comparative Psychobiology, Yale University. The investigation, furthermore, was made possible by a National Research Fellowship in the Biological Sciences and by an additional grant to Yale University from the Committee for Research in Problems of Sex, National Research Council. The author gratefully acknowledges the many services of the United Fruit Company and the Chiriqui Land Company given through their representatives, Mr. Sterling Blair and Mr. Kenneth Block.

The expedition into the Coto Region in 1932 was a coöperative undertaking planned primarily for the purposes of collecting both live and dead specimens of red spider monkeys and of observing their natural activities and group life. The other monkeys of the region were of secondary interest. Apart from the author the following scientists engaged in the undertaking: Drs. Robert Hegner, Herbert C. Clark, George B. Wislocki, Adolph H. Schultz, and Carl M. Johnson. Their subjects of study were: Intestinal protozoa, pathology, reproductive anatomy, and physical anthropology.

The writer returned to the previously established camp in February, 1933, accompanied by Mariana Evans Carpenter and two natives. His purpose on the first expedition had been to gain experience in the bush along with experienced field naturalists, to explore the possibilities of making a comprehensive study of red spider monkeys in their natural environment, and to begin such a study if favorable conditions were found. The second expedition was carried out in order to supplement the data previously acquired, to collect a colony of live spider monkeys for use in the laboratory, to collect a series of female reproductive tracts for histological study and comparisons, and finally to obtain motion and still photographic records of the activities of spider monkeys.

PROCEDURE

Observational work was confined to a sector of forest near camp which was reserved for this purpose. It was found to be more advantageous to concentrate work in a small area and to become thoroughly familiar with the region and its animals than to work over a large unfamiliar territory. No hunting was permitted in this area, because hunting and successful observation are inconsistent. The sector, which came to be known as the Yale Quadrant, was thoroughly mapped, especially with reference to food trees, to trees where spider monkey colonies were found to spend the night, and to places where the groups tended to spend rather long periods of time resting and playing. A net-work of inconspicuous pathways was laid out through the area and direct paths were cut from food tree to food tree and between other loci of activity.

Four large groups containing a total of about one hundred animals inhabited the reserved quadrant of forest; thus there were plenty of animals for observation. Ordi-

narily, these groups of spider monkeys awoke at dawn and began travelling immediately; they fed, moved, rested, and played periodically during the day. At dusk they returned to one of several customary "abode" trees and settled down for the night. At times a group would spend eight or ten successive nights in the same tree or trees. Groups of these animals travel rather rapidly, thus making it difficult to follow them through the tangled forest. Even when undisturbed, bands of spider monkeys scatter over a considerable area when travelling; and when disturbed by an observer, the groups split up into a number of subgroups that may become separated by spaces of as much as four or five hundred yards.

It was necessary to be content mainly with observation of subgroups, for entire groups could not be followed for long periods of time. Two plans of observing were used. These were frequently alternated: (1) Animals were watched from ambush; and (2) subgroups were followed closely for the longest possible time during a day's work. It was impossible, during the relatively brief period spent with the animals, to accustom them to the presence of the observer.

Many dead specimens were available for close examination. Twelve live infants and juveniles were collected in 1932, and sixteen in 1933. Close range observation of these living animals aided greatly in classifying the monkeys seen in the wild with regard to sex and to stage of development. While working in regions other than the one reserved for behavioral observation, it was possible to collect females judged to be in a state of oestrous, to remove the reproductive tracts, and thus to correlate behavioral and anatomical information. Also, it was possible to collect pathological individuals, and even entire subgroups, e.g., a subgroup of males, in order to check field observations.

Experiments were made with methods of trapping live spider monkeys. It was found that the animals avoided suspended ropes with trigger releases, as well as other types of arboreal traps. Experiments were also made with tear gas. This method, although promising, was found to be impracticable under the prevailing conditions and with the help that was available. The primitive method of shooting the mother that carried a young one of desirable size and then recovering the infant from the dead animal was resorted to with success. Two well trained natives could thus collect an average of two young monkeys each day.

REACTIONS OF SPIDER MONKEYS TO MAN

When approached, these animals typically begin barking. Frequently they approach the observer. The usual terrier-like bark of great excitement may at times change to a metallic chatter repeated with great frequency. When males, and sometimes adult females, are closely approached they may growl in a strikingly "vicious" manner. Typically, the animals come to the terminal parts of branches, often to within forty or fifty feet of the observer, and shake the branches. This may be done with either the hands or feet; or both the hands and feet may be used while the animal hangs by its tail. Concurrently and almost invariably, vigorous scratching occurs. Of this there are varied patterns. The hands may be used either singly or together to scratch the sides, back and shoulders opposite to the hand that is being used. Occasionally both hands will be used to scratch one foot or both feet consecutively, or both feet may be used to scratch an extended arm. There may occur along with these actions, running movements of the hind legs while the animal hangs suspended by its hands or tail or by both together. These may possibly be incipient escape movements. If seated, the animal may sway back and forth and vocalize noisily.

The breaking off and dropping of branches is a conspicuous part of the reactions of spider monkeys to man. Very frequently these animals break off and drop limbs with close reference to the observer. Any experienced native will warn one of this source of possible danger. Green branches sometimes, but most often large dead limbs weighing

up to eight or ten pounds may be broken off and let fall toward the observer. One can well imagine the impact of one of these missiles when dropped from forty or fifty feet above the ground. This behavior cannot be described as throwing, although the animal may cause the object to fall away from the perpendicular by a sharp twist of its body or a swinging circular movement of its powerful tail. The dropping of objects from the trees with reference to a disturbing person may be considered, apparently, as a defensive adaptation arising from the more generalized habit of shaking branches. A significant variation of this habit occurs when the animal breaks off a limb and holds it for a time varying from a few seconds to half a minute or more before letting it fall, especially in situations where this delayed action results in the limb's falling closer to the approaching observer. Related to this behavior of dropping objects toward the observer is the common activity of releasing fecal matter and urine with reference to him. It seems quite clear that these behavior patterns can be classed as "instrumental acts" carried out with reference to particular defensive objectives.

The reactions of spider monkeys to man show three rather clearly differentiated variations:

1. Aggressive, moving-toward, "bluff" reactions occur most frequently. Almost always animals show this type of reaction when first approached and for a short time thereafter.

2. Following the initial reaction, during which time the excitement of the animals increases, flight reactions are shown. During these responses, the group splits up into a number of subdivisions.

3. Animals that have been hunted and shot at may remain perfectly quiet and partially concealed when they are approached. This type of defense reaction is very effective in causing one to overlook the animals. In general, spider monkeys behave toward man as they would toward an enemy; he is something to be driven away or to be fled from.

FOOD AND FEEDING ACTIVITY

Red spider monkeys have been classed correctly as frugivorous. It is estimated that about 90 per cent of their food consists of fruits or nuts. The animals may live for considerable periods of time on only the one or two kinds of fruit which are then in season. In June, 1932, "bogamani" or wild nutmeg formed a most important part of their diet; this nut is eaten for the mass of red aril which lies beneath the thick hull. As many as ninety of the kernels, which are as large as a small hickory nut and which are swallowed whole, may be found in the stomach and intestines of an adult spider monkey. "Berba" and "berbacilla," bean-like nuts found in abundance in the forests of the Coto Region, were also of great importance as monkey foods. These nuts are evidently rich in nutritive value, because the monkeys were exceedingly fat while they were feeding on them. In February, 1933, when only a few "berbacilla" were to be had, the animals looked much less well-fed than during June of the previous year, at which time the specimens collected were very fat. In February, 1933, they were eating "higo," "higeron" (wild figs), "bogamani," a few "berbacilla" which matured early, "sandi," "guyava," "cainito," and several fruits that were not identified. The following trees, named according to Standley (1933) are some of the most important sources of food for the spider monkeys: *Ficus costaricana, Ficus glabrata, Helicostylis latifolia, Virola panamensis, Virola warburgii, Persea americana, Licania platypus, Inga edulis, Inga goldmanii, Inga spectabilis, Dipteryx panamensis, Anacardium excelsum, Anacardium occidentale, Spondias mombin, Rheedia madruno, Gustavia superba, Psidium guayava, Chrysophyllum cainito.*

Little is known of spider monkey foods other than fruits. The animals may at times be seen searching through leaves, under bark and in dead limbs, apparently for larvae and insects. No evidence was found to indicate that they eat birds' eggs or young birds

from the nests. They consume small quantities of buds and flowers, but these constitute an insignificant part of their diet.

Spider monkeys begin feeding shortly after dawn. The most active period of feeding occurs between daybreak and about 10 o'clock; this period of heavy feeding is followed by one of comparative rest for the adults and play for the young. Feeding in the afternoon is less active and more sporadic than in the fore-noon. It may continue until dark.

LOCOMOTION

The locomotion of spider monkeys is developed more toward the orthograde type than in other platyrrhines. The brachiating movements of these monkeys approach the form of arboreal locomotion characteristic of gibbons. Normally, spider monkeys travel along the upper surfaces of limbs, using all four feet and carrying the tail arched over the back. It is principally while crossing from one support to another that brachiating occurs. At this time, too, the powerful tail is brought into play as a suspending appendage. During these movements the hands, arms, and tail are used to make contact with supports. Spider monkeys show a strong tendency to keep their heads upward; therefore, when descending a perpendicular limb, vine, or tree trunk, they go backward rather than head foremost like howlers. While passing along a horizontal limb, the long, four-fingered hands are turned outward on the support; during brachiation, the hand becomes an effective hook.

They frequently make long jumps outward and downward, covering at times more than thirty feet. While jumping, an animal spreads all of its appendages, thus increasing both the air resistance and the possibility of making contact with the objects toward which it is jumping. Several times animals have been seen to release all holds and drop straight downward for twenty or twenty-five feet to lower limbs or tree tops.

The average speed of locomotion is about that of a man walking at top speed. Generally speaking, they show a great variety of forms and speeds of locomotor activity. Their motions are much more flexible than those of howlers.

TERRITORIALITY AND NOMADISM

Groups of spider monkeys are semi-nomadic, that is, each group inhabits an area of the forest which, though fairly definite, may overlap the territory of other groups. Within this territory, they wander about with their activities centering around food and lodge trees. Shifts in territorial range undoubtedly occur, but apparently the change is slow. In June, 1932, there was, in the area reserved for observational work, a clan that could be identified from day to day with considerable certainty. Almost every night this group slept within ear-shot of camp in trees across the river. For eight successive nights the animals returned to the same clump of "nispero" trees. Throughout the day, the group travelled, in general, over the same routes from one food tree to another and to and from favorable places in the deep forest where the mid-day "siesta" occurred. Several other groups were regularly located in their own particular home areas. Experienced hunters know and make use of the fact that groups tend to inhabit special areas.

Little is known of the factors that regulate the limits and the shifting of territories of different groups. It may be assumed, however, that the size of the group, and the availability of food and of favorable trees in which to play, rest, and spend the night are influential. The competition of groups in adjacent regions would also be significant. It would be expected that changes in the territorial range would occur coincidently with the seasonal variations of the food supply.

It seems reasonable to suppose that a clan becomes adapted to a particular area partly because of the facilitation established through feeding, constant association, resting, playing, and other normal daily activities. The locations of food trees, of

arboreal travel routes, and of places favorable for other kinds of activity are soon learned. They then function as attractive "goals."

ORGANIZATION OF SPIDER MONKEY GROUPS

This preliminary study indicates that spider monkeys have a form of group organization which differs from that described previously for howling monkeys (Carpenter, 1934).

Typically, an observer finds spider monkeys in small groups. These may consist of (a) a female and one or more young, (b) a number of females with their respective young, (c) one or more males and many more females with their young ones, or (d) males only. If these smaller groupings are followed for a day, it will be discovered that they eventually join with others in various combinations. The subgroupings first observed may belong to a larger grouping that contains as many as forty individuals. To reverse the description, if the large group is found in the early morning and closely observed, it may be seen to divide into many smaller groupings that become separated from each other for varying distances and for different periods of time during the day. The divisions of the larger group or over-group will keep more or less in touch with each other by means of vocalizations that are exchanged among them. The individuals that make up the subgroups usually stay within sight of each other.

Table I gives the composition of 19 subgroupings which are random selections of types as observed in many clans and recorded in field notes. The variability of the groupings as to number and composition and the ratios of adult females to adult males is especially worthy of consideration. In addition to the groupings that are listed in itemized form in the table, seven other subgroupings were observed which contained only adult males with no females or young. These male subgroupings constitute a distinguishing characteristic of the organization of spider monkey societies.

A study of the temporary subgroupings of spider monkeys seems to warrant their classification into three categories: (a) male subgroupings, (b) female subgroupings (exclusive of the young found with them), and (c) mixed subgroupings. All three kinds of subgroupings are usually found, so far as available data indicate, in each large, relatively stable group or association.

With three exceptions the subgroupings listed in Table I contain both males and females. Subgroupings 7, 13, 16 and 18 may be considered compound in the sense that each contains male subgroupings which moved rather closely with the other individuals. The first subgroupings (no. 1) in the table consisted of a mother and an infant (still in the dark color phase) which she carried on her belly, and a semi-independent juvenile. Of the sixteen subgroupings which contain males, one has an equal number of adult males and females, four have more males than females (these counts include the exclusively male subgroupings) and eleven have more adult females than males. As yet the data are too limited to permit of statistical treatment of the groupings and it is impossible to ascertain the central grouping tendencies and the characteristic socionomic sex ratio (ratio of males to females living within groups).

The male groupings range in size from three to ten individuals; two subgroupings have three, two have five, and in the others there are four, seven, and ten adult male animals. All the animals forming several of these groupings were collected in order to show accurately what types of individuals composed them. A. H. Schultz and the author, judging from dentition and physical development, have concluded that the members of these subgroups range in age from early adulthood to senility. Some of the sets of teeth were perfect and well developed, others were "young," while still others were "old." These findings oppose the theory that all males living in unisexual subgroupings or as "solitary" individuals are so old or weak that they cannot meet the competition within the main group.

The subgroupings that have been described associate in various combinations to make up the typical society of spider monkeys. The total number of animals in one particular

major group was learned after intensive study and after several fortunate opportunities had occurred of observing the entire clan as it came into or left abode trees. In February, 1933, the group contained thirty-three animals of all classes. There were eight adult males, fifteen adult females (four of which carried infants), and six semi-independent juveniles. During the last week of the same month, this large group was repeatedly found broken up into the following more closely associated subgroupings: (a) a male subgrouping of three well matured and one immature male, (b) a subgrouping of four mothers with their infants, plus four females, five juveniles, and one male,

TABLE I

Subgroups of spider monkeys

NUMBER	MALES	FEMALES	MOTHERS	INFANTS[1]		JUVENILES[2]		TOTAL
				No. 1	No. 2	No. 1	No. 2	
1			1		1		1	3
2	1	1				1		3
3	3	1	1		1			6
4	2	3					1	6
5	3	1	1		1	1		7
6		3	1		1	1	1	7
7	5	1				1		7
8	1	6					1	8
9	1	2	1	1		3		8
10		2	3	1	2			8
11	1	4	1		1	1	2	10
12	3	4				1	2	10
13	7	2					1	10
14	1	4	2		2	1	1	11
15	2	3	2		2	2	1	12
16	5	4	3		3			15
17	2	5	2		2	3	2	16
18	5	4	2		2	3	1	17
19	4	4	2		2	3	2	17
	46	54	22	2	20	21	16	181

[1] Infants are those young that are in the dark color phase and are mainly dependent on their mothers. Infants classed as number 1 are carried on the mother's belly or side, those classed as number 2 are carried on the mother's back.

[2] Juveniles are those young that are semi-independent of their mothers but are closely associated with them in subgroups. Number 1 and number 2 juveniles are differentiated on the basis of size and their relation to their mothers.

(c) a subgrouping of six females, one juvenile and one adult male, and (d) a subgrouping of two adult females, one adult male and one juvenile. All that could be learned about the groupings of other clans substantiates the supposition that the one described is fairly typical for spider monkeys. Additional information is needed to give the range of variability in this type of primate grouping.

Available data do not permit generalizations regarding the socionomic sex ratio in spider monkey groups. Such facts as we have indicate strongly that, even including the males of unisexual subgroupings, there are more adult females in the groups than there are adult males. This is comparable with the condition found in howling monkeys

(Carpenter, 1934). Wislocki (1930, p. 177) and Schultz, by means of random collecting of animals, found "a great preponderance of females in the spider and howling monkeys."

REPRODUCTIVE BEHAVIOR

Copulation was not seen in the free ranging spider monkeys, but patterns of secondary sexual behavior were observed. These consisted in the male's manipulating the greatly developed clitoris of the female, embracing her, currying her, and chattering.

Considerable qualitative evidence has been gathered that indicates that the red spider female has a rather definite oestrus period. At times females could be observed unusually closely associated with one or more males. On two occasions females were collected after prediction on the basis of their behavior that they were in oestrous. One of the females was associated with a single male and the other was associated with the several males of a mixed subgrouping. Recently formed vaginal plugs were found in both of these females. The walls and lumina of the vaginas were greatly enlarged as compared with those of females suckling young.

Spider monkeys in the wild have no distinct breeding season. In June, 1932, and in February and March, 1933, all sizes of infant and juvenile animals were seen, and representative stages throughout the development of embryos were examined. The conclusions reached by Wislocki (1930) and Schultz that these animals have no breeding season, and the same opinions expressed by other naturalists, are confirmed by the observations made during this study. There still remains the possibility, however, that there may be considerable fluctuation in the number of young born during the different parts of the year.

RELATIONS OF MOTHERS AND THEIR YOUNG

For a short while, possibly not more than one month, an infant spider monkey is carried on the belly of its mother, and after this interval it rides the mother's back in the sacral and lumbar region. During locomotion of the female, the tail of the infant is coiled around that of the mother close to its base. The feet of the infant clamp themselves into the mother's flanks and the hands grasp the hair of the mother's sides.

Young spider monkeys pass through a black color phase during approximately the first six months of their lives, as has been determined from a captive specimen. After this they begin to take on the reddish coloration of the adult; this color phase is fully developed when the animals are about ten months of age. During the black color phase, the young are almost entirely dependent on their mothers. They are rarely seen travelling alone during progression of the clan, and are usually found close by the mother while she is at rest. Such young are classed as infants in Table I. The period of "infant dependency" in spider monkeys is seemingly much longer than in either howlers or capuchins. The young spider monkeys are dependent to a large extent on their mothers until they are well into the reddish color phase, i.e., until they are about ten months of age. Then they gradually pass from a period of dependency to one of independence.

Sixteen infants were collected and some of the older of those caught were in the weaning period; others were in the early part of the reddish color phase. The weight of these animals ranged from 768 to 2270 grams. They averaged 1579±486 grams. The larger infants are rarely carried by their mothers. A captive specimen that weighed 2000 grams was approximately twelve months of age. The largest of the monkeys captured were just cutting their permanent incisor teeth, and this checks with the fact that a young animal raised in captivity cut her lower incisors when between eleven and thirteen months of age. When she was fifteen months old, all four incisors were fairly well developed.

Female spider monkeys appear to be more careful of their young than are howler

females. Spider monkeys have been seen to travel across several tree tops, catch their infants, put them on their backs and carry them away. At times the females behave as if guarding their young from other monkeys or from a human observer or hunter. Like howlers, spider monkeys help their semi-independent infants across difficult places in the arboreal pathways. This is usually done by pulling together the separated vines or branches over which a crossing is to be made. Sometimes there are periods of delay of forty or fifty seconds between the time when the female pulls the supports together and the young makes the crossing. At other times the females take the young ones on their backs, carry them across the difficult passage and then put them off on the other side. Most unusual is the observation of a female spider monkey that held a vine close to a tree trunk while five young animals, which could not otherwise have crossed, passed from the vine to the tree.

GROOMING AND PLAY

A few instances of grooming were observed in spider monkeys in the wild. This form of activity occurred particularly between females and their young ones. Usually, the females picked through the hair of their young without, as far as could be ascertained, putting their mouths to the hair or skin of the young animals. The females would make long downward currying movements of their hands over the infants. More finely adjusted movements were shown as one animal parted the hair and searched over the skin of an associate. In zoölogical gardens, spider monkeys have been seen to explore the hair and remove particles from one another in a manner similar to the grooming behavior of macaques. Apparently this activity is more prominent in capuchins than in spider monkeys. It is rarely seen in howlers.

A relatively great variety of play patterns is shown by young spider monkeys. Little if any behavior that might be interpreted as play occurs among adult animals. Individual play patterns consist of running, jumping from one branch to another or standing still and jumping up and down, swinging from a limb by means of one or several possible combinations of the appendages, and playing with sticks or other objects. Very young animals have been observed playing with their feet, tails and sexual organs. The greater amount of spider monkey play may be correctly considered as social, involving as it does more than one individual. Young spider monkeys may chase each other for hours over circuitous routes, or may catch and bite each other. Wrestling is a prominent form of play. This may occur when the young ones are sitting on a limb, but frequently it occurs when they are swinging by their tails. Once four young juveniles were seen swinging together from a limb and wrestling vigorously.

COÖRDINATION AND CONTROL OF GROUPS

The coördination and control of groups are mediated by complex behavioral patterns and responses to them. Means of control and coördination are contact or forceful control, gross movements, gestures and vocalizations.

A female may control the movements and postures of her infant by forceful directing. Thereby the behavior of the two animals may become coördinated. After repetition of this many times, possibly through a process of redintegration, the young come to respond to reduced cues; e.g., it is finally no longer necessary for the female to go to the infant, pick it up and put it on her back, for her movement toward the infant produces a response in the infant of mounting the female and assuming a position suitable for carriage.

Postures and bodily attitudes become means of communication among animals that are as closely associated as the individuals of a spider monkey clan. The posture of a receptive female or the posture of a male or a female that is preparing to attack, may call forth in other animals anticipatory behavior of either approach, attack, or flight.

Postures of certain animals seem to signify forth-coming action; associates seem to prepare for the subsequent action by responding to anticipatory postures.

Gestures and their significance in social coördination cannot be discussed adequately with the data available. Captive specimens show a great variety of facial expressions which undoubtedly become associated with certain states of motivation and call forth fitting responses in associates. The protruding lips, squinted eyes and wrinkled forehead seem to indicate an attitude of approach and friendliness. The half-open mouth emitting a series of grunts would seem to indicate sexual receptivity.

Only a few of the many types of vocalizations can be described along with the situations giving rise to them and the responses that they call forth from associates. The terrier-like bark occurs regularly when spider monkeys in the wild are approached by an observer. Defensive action or flight are concomitant types of response. The barking also occurs when two strange or neighboring groups meet. Within the group, the barking serves as a warning signal to other animals. This barking corresponds to the howls or barking roars of howlers (Carpenter, 1934). Growls are given by adult spider monkeys, mainly by males, when they are closely approached by an observer and when they are greatly aroused. This type of vocalization may also be heard when subgroups or groups are contending with each other. The third most frequently heard vocalization resembles the whinny of a horse, with a higher pitch and less volume. This vocalization occurs when subgroups or individuals become separated, and the apparent function of the sound is to coördinate the movements of separated subgroups within a clan. The whinnies of spider monkeys correspond to the caws characteristic of capuchin monkeys. These are just a few of the many stimulus acts characteristic of spider monkeys that aid in the coördination of the group.

Pugnacity is the natural force used to instrument social motivation and control in animal groups. The few instances of fighting that were observed consisted of males contending with each other. The males growled, clinched, bit, squealed, and then separated. Several specimens have been collected that showed large scars on the hands, shoulders and head; some had their ears torn. Biting is the effective way of fighting for these animals. It is just probable that the seriousness of the fight helps to determine the short duration of encounters and the infrequency of their occurrence.

Groups of spider monkeys seemingly have no highly centralized social control. In many types of animals, groups are dominated by a single leader, frequently an old male. Control in spider monkey groups is more diffuse. It seems to rest mainly with the adults, either male or female, of the subgroups. Females take an active but subordinate part in leading and defending the group and subgroup. When a group is disturbed, the males, including those in the male subgroupings, rush toward the place of disturbance and under these conditions, rudimentary types of coöperation are to be observed.

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REARING MARMOSETS IN CAPTIVITY

By Alice Fitzgerald

[*Plate 4*]

The following observations are based on the author's experience with eleven adult marmosets (*Hapale jacchus* Linnaeus) kept as pets, mostly in New York City, during the years 1931 to 1934. During this period seven young were produced, six of them as twins. Three of these young were stillborn at term. A fourth was born prematurely. For another account of the breeding of marmosets in captivity see Lucas, Hume, and Smith, Proc. Zool. Soc. London, 1927, pp. 447–451.

The author wishes to acknowledge gratefully the assistance given to her in the preparation of this article by Dr. Charles V. Noback of the New York Zoological Park, the Bronx, New York, who gave generously of his valuable time to direct and correct these observations.

CARE OF MARMOSETS IN CAPTIVITY

Method of housing.—The cage was especially designed and constructed to house a number of marmosets, and to be moved with comparative ease. It consists of two units, one made a little smaller than the other so that it could be telescoped into the larger one. Full length of cage, open, 46 inches; closed, 24 inches; width of larger unit, 24 inches; width of smaller unit, 22 inches; height of larger unit, 30 inches; height of smaller unit, 27 inches. The cage is provided with a box play room that hangs inside, and with another box that hangs on the open door at night and serves as sleeping quarters. Both boxes are kept lined with clean blankets. These are never soiled by the animals except by foot prints. Perches are placed at strategic points to provide a maximum of exercise, and platforms or resting shelves are provided near the hanging lights (see below). A pad of rubber ¾ inch thick is placed in the bottom of each cage and kept covered with clean paper. In addition to their cages the animals need to have the run of a room for exercise.

Heat and light.—Important considerations in the care of marmosets are temperature, sunlight, food, water and cleanliness. In the experience of the writer the temperature should never fall below 75°F at any time. Higher temperatures do not seem to harm the animals. Direct sunlight is avoided by marmosets except for a few minutes at a time. During the winter, a 75 watt blue electric light bulb was kept lighted in each cage throughout the day. The animals gathered around the bulbs with apparent pleasure. A single G.E. sunlight lamp was used to furnish artificial sunlight for a few hours daily except during two summer months when the marmosets were kept in a screened porch in the country.

Feeding schedule.—The daily feeding schedule that has been used successfully for nearly four years is as follows: In the morning, orange or prune juice, very ripe sliced bananas, fresh milk, grapes, apple sauce, and about ten meal worms to each animal. At noon, small pieces of raw beef with much fat attached (occasionally scraps of other meats), a variety of cooked vegetables (string beans preferred), sliced canned peaches with the daily ration of viosterol (one or two drops to each animal). Fresh water and lumps of sugar are always kept in the cage. Crackers (not too sweet and not salty), peanuts, bread crumbs, boiled rice or potatoes, any kind of fresh fruit, white of egg (raw or hard boiled), may be given occasionally. In fact any food safe for a human

seems to be safe for a marmoset. The only exception to this rule made by the writer is that she has never given fish to the animals. Some individuals will eat yeast.

Rickets or "cage paralysis."—Captive marmosets ordinarily succumb to diseases of malnutrition known to laymen and dealers by the vague term "cage paralysis." The symptoms are progressive weakness of the hindquarters (rarely of the anterior extremities), constipation, marked irritability and fear, inattention to grooming. Masses of dirt accumulate on the nails.

Unless the condition is recognized early enough the animal at last becomes so weak that it cannot move even to obtain food or water. The animal at such times should be placed in a small cage by itself with food and water within easy reach; if very weak, it should be fed by hand. Isolation, quiet and great cleanliness are necessary. If the disease is not checked, softening of the bones and deformities such as bowing of the legs gradually develop. Such changes are characteristic of rickets. The affected animals usually succumb to a terminal pneumonia or enteritis.

SOME PHYSICAL AND MENTAL CHARACTERISTICS

Descriptive notes.—The common marmoset is too well known to need detailed description (see the portraits, pl. 4), but a few of the less familiar details seem worthy of mention. The hairs covering the body are of four colors, each hair being gray at the root, then golden brown, then dark gray and finally lighter gray. Variation in these multicolored hairs produces differences in general body color and makes some individuals grayer or browner than others. The well defined white spot on the middle of the forehead is present in all adults; but it is not fully developed until the animals are two years old. The conspicuous ear tufts vary in color from white to brown. They vary in extent from a bunch of hairs in front of the ear to an encircling ring around the entire ear.

Smell and sight.—The sense of smell is not highly developed. Food is tested by tasting rather than by smelling. The sense of sight is very keen and is constantly being stimulated by the innate curiosity of the animals; any change in the position of an object, or any addition to the furnishings of the room is at once investigated. Any figure, however small, representing an animal causes great excitement; a small carved wooden carabao from the Philippine Islands had to be removed from the room as it caused a panic among the marmosets. Pictures, on the contrary, seem not to convey any idea to them. Preferences for special colors have not been observed. The eye is effectively used to "command."

Voice.—The marmoset is not a noisy pet; in fact the usual chatter of contentment is very much like the chirp of a canary; there is a louder cry of alarm, and a scolding sound much resembling a short cough.

Feeding and elimination.—When the animals are in good health their appetite is very regular and their elimination is sufficient. Elimination takes place very freely and regularly early in the morning when the marmosets first come out of their sleeping quarters where they have remained 13 or 14 hours. They never soil their sleeping quarters or their play room, and they always let their feces fall over the side of the cage or perch. They are not interested in the dejections, and they do not repeatedly use a particular place except for convenience. Only one animal, an adult female, has been troubled with constipation. This difficulty has become less since she has at last consented to eat vegetables.

Sleeping.—The sleeping habits are regulated by the clock and not by the sun; the animals sleeping from 13 to 14 hours out of the 24. In addition to their night's rest, marmosets generally take a "siesta" after their luncheon.

Molting.—As a seasonal occurrence, molting does not take place; but a few stray hairs may be found on the blankets at any time all the year around. An exception to

this rule was observed in the case of two marmosets that, when bought, had coats in a terrible condition. Eventually they lost their fur in large patches. The new coats were beautiful and the animals never molted in this unusual way again.

Grooming.—The grooming of the hair is a very important part of the animal's life. Much time is spent in the process. Grooming consists in separating the hairs (its own or those of another animal) with the fingers and nails, the groomer watching intently all the time for particles of dead cuticle or bits of any foreign substance that may have lodged in the fur. When found, such objects are picked up by the lips, which are kept moistened by the tongue. Much interest and anticipation are shown by the groomer. The request for grooming comes from the "groomee" who approaches the groomer and, facing him, lies down flat in an inviting attitude. The animal that is being groomed relaxes completely, but keeps moving its body so as to present every part of it in turn for inspection. The eyes of the groomed animal may close; his facial expression is always one of ecstatic contentment. No noise of any kind accompanies the operation.

An experienced groomer sits on his haunches and has perfect freedom and control of his arms; but a novice has to lean on the groomee and has to use only one arm at a time. The marmoset does not sit up with ease until its third year. The older the groomer, the more thorough his work; and a good groomer is in great demand. The process can at times be quite painful; for instance, when a matted bunch of hair must be untangled or removed. I have seen an animal raised off the floor by the groomer's efforts to bite away such a tangle. Some animals welcome a daily fine-tooth combing. Sometimes the combing is painful, but no sound or effort to escape is ever made. Grooming is extended to the mouth, where the teeth are gone over with particular interest.

Play.—Playing is an important part of the life of the marmoset. It consists mainly in hiding and seeking. The animals slap at each other, playfully attempt to bite each other, and race wildly in all directions. While playing they are apt to misjudge distances and to fall; but generally they land on their feet. In temperament, the marmoset is highly nervous and easily startled and frightened; but a disturbed animal soon resumes its normal state and its regular routine in sleeping, eating, and grooming. The marmoset is not considered (by this writer) an affectionate pet. Even when tame and easily handled it does not show any pleasure when greeted nor any sorrow when left alone.

Miscellaneous characteristics.—Human strangers are studied from head to foot, and the marmosets are apt to come forward and make grimaces at them by drawing back their ears and raising their faces with puckered lips. They may also turn their posterior extremities towards the visitors. This latter gesture, however, is also used in play with those with whom the animals are familiar. It then invites to a friendly rough house with the hand.

The tail is used for balancing purposes when the animal is moving about, or as the third leg of the tripod when the animal is sitting on its haunches. The waving of the tail seems to be a signal denoting illness. Very sick or dying animals may continue to wave their tails up and down until relieved or dead.

As a rule marmosets are not quarrelsome, but in some isolated cases permanent antagonisms have been observed among them. In one instance a mother and her eldest daughter have never been friendly. Scolding outbursts occur quite frequently between them; these, however, have never gone as far as a physical attack. A pair of twins (females) had a quarrel that lasted two days and caused their mother to spend much time stepping in between them to prevent bodily violence. A second example of quarreling was exhibited by two other females (evidently twins) bought from a local dealer. From frequent quarrels the differences led to real fighting. After some serious damage had been done, mainly to feet and tails, these two animals had to be separated. Most quarrels between males can be definitely traced to sex problems and to desire for supremacy in the family unit. A fight between two animals of opposite sex has never been observed.

It is essential not to frighten marmosets with any sudden noise or movement, as either one will throw the group into a panic. Noises practically inaudible to the human ear may have this effect. The disturbed state of mind of one animal seems to spread to others through voice contact.

Habits in the family circle.—The confidence of this animal in the human being is quite subordinate to the tie that binds the family group together. Even to this day the whole group will turn on the writer for any imaginary wrong done to any of its members. A sudden movement in the direction of one animal will bring the others to his defense. The authority of the older members seems to be recognized and respected by all; and obedience is enforced by scolding, cuffing, or by the "eye command." They never really bite or attempt to bite except in great anger when fighting.

No apparent effort is made by the animals to care for their sick, although they may recognize impairment of locomotion and leave a sick animal strictly alone. A cry of pain or distress from an older animal does not bring to him the same assistance as that so quickly given to the babies under the same circumstances.

The offspring show marked deference to their parents, and though a young one may sometimes "answer back" when corrected, he never goes so far, under these circumstances, as to lift a paw in self defense. On the other hand the parents when annoyed often slap and cuff their young. This mild form of discipline seems to have the desired effect.

The parents seem to recognize the helplessness of the young. A cry of distress from a young one will bring the adults rushing to the scene. As the young grow more independent the parents show less concern; but there is always a strong family "esprit de corps," and the whole group will come to the help of any member uttering a cry of distress or anger.

The marmosets do not examine each other's genital parts nor are they given to any decided public display of sexual emotion. During love-making, long and intense staring accompanies rapid opening and closing of the mouth with frequent moistening of the lips. At such times no sound is uttered. Mating was not seen. Consequently it must have taken place in the sleeping box or during the author's absence.

Little is accurately known about the types of sexual association prevalent in different non-human primates. (For summaries the following publications may be consulted: Zuckerman, The social life of monkeys and apes, London, "1932," December 1931; Miller, The primate basis of human sexual behavior, Quart. Rev. Biol., vol. 6, no. 4, pp. 372–410, December, 1931; Yerkes and Yerkes, Social behavior in infrahuman primates, A handbook of social psychology, pp. 973–1033, 1935.) It is hoped that the author's observations, based on a study of her small group of marmosets, may contribute something to our understanding of this subject.

Before coming into the author's possession a pair of marmosets had lived with a former owner for about 4 years. Their eldest daughter was born during this period. Throughout the time that the author observed this group the male was continuously devoted to his mate. If the female moved a few inches he would at once follow and place himself alongside of her. At the time no other male was in this group. Later, when the eldest daughter was about three years old she was very large, well developed and apparently quite mature. At no time was the male seen to pay any sexual attention to her. In another cage nearby were now another male and female, fully grown, and still the first male courted no one but his mate. In yet another cage were two particularly fine females. They likewise proved to be no attraction to the first male in spite of the fact that he had the run of the room and could easily have made advances to any of these females, had he wanted to. Since the first male's death, two other males in turn have become leaders of this family group. Although both of them had previously

made advances to the eldest daughter each restricted his attentions to the mother when he was promoted to leadership. These facts lead the author to believe that the common marmoset is naturally monogamous.

THE PARENTS, OFFSPRING AND NURSE

The animals on which the most detailed observations were made were as follows: In February 1932 a particularly large and handsome male, called "Father" in this article, his much smaller mate, "Mother," and their daughter, "Mischief" (born in this country), also very large, about one year old, were given to the writer. They were all white-tufted and in good condition. During the summer of the same year "Biggio," a very small, brown-tufted male that had been kept in a separate cage, elected to join the family group, portraits of whose members, together with that of a third male, "Tweedledum" are shown on plate 4. Although his company was acceptable to the other animals during the day Biggio was not at first allowed by them to spend the night in the family bed room. At the end of three days Biggio decided to take matters into his own hands. He retired to the family bedroom before the others, and was not thrown out by them when they came in. From that night Biggio became a member of the family. Mother paid practically no attention to him but Father seemed fond of him and would nuzzle him from time to time, much to the little one's delight. Mischief, not fully mature, paid no attention to the newcomer.

RECORD OF A MARMOSET BORN IN CAPTIVITY

The following notes are taken from a diary started after the birth of the second offspring of Father and Mother, September 14, 1932.

First 48 hours.—Birth of twins during night; one, the largest, still-born. Father hugging and licking the corpse. No objections made when the body was removed. The umbilical cord was bitten off close to body. Mother and Mischief were seen eating placenta. Very little trace of blood on blanket or in cage. Baby (a female), afterward named "Minor," seen clinging to underside of Mother entirely by its own strength and with no help from her. Mother seemed exhausted during first 24 hours and remained much of this time crouching in a corner but taking food and liquids freely. Baby moved frequently but remained under Mother's abdomen.

Third day.—Baby plainly visible on top of Mother. It is covered with short, very dark hairs and its face is almost black. (Face does not assume the adult color until second year when all the lighter hairs have grown in.) Eyes very dark; already blinking in the light. Body length of baby about 2¾ inches. The head seems slightly larger in proportion than in the adult. The tail shows well marked light colored rings, the only relief from the general dark effect. Baby balances itself perfectly no matter how much Mother moves around. Father very attentive. He frequently licks and cleanses the baby's posterior parts; this cleansing is also done by the eldest daughter. Biggio, the unrelated male, remains constantly at Mother's side and no one seems to object to his presence.

Fourth day.—Baby found clinging to Father (transfer is made from Mother's back to his by baby itself); this is a severe test of its strength as Father frequently leaps around the cage and is quite abrupt in his movements. Shortly afterwards the baby was found nursing again. All members of the group are very attentive. They take turns at cleansing the baby. Baby was found later in the day on Biggio's back. Thus began Biggio's career as "bachelor nurse." The animals were watched for about an hour. During this time Biggio "scolded off" both Father and Mother and ran from them with his precious cargo; shortly afterwards the baby was again nursing.

Fifth to seventh days.—Biggio has a full time job and carries the baby practically all day long except for nursing periods. Nursing occurs almost every hour for about ten

minutes at a time. After nursing, the baby transfers itself to Biggio, who is always on the spot to receive his charge. Father's responsibilities are limited to keeping the baby clean, and Mother's to nursing it; the sister, "Mischief" keeps carefully out of the way. When evening comes, and Mother has taken the baby to the sleeping quarters, Biggio settles down to a good hearty meal.

By accident, the baby got on Mischief's back today. Mischief at once tried to pass it on to Father and then to Mother who accepted it. Although the transfer is generally made from back to back, both parents can be said sometimes to "take the baby" by stretching out their arms and drawing it to their breast. Both Father and Mischief refuse to carry the baby. If it clings to them they rub it off against the side of the cage. Mother always answers the call of distress and takes the little one. Baby definitely moves towards the friendly arms of Mother or Biggio when in trouble. Baby nice and fat and uttering a faint twitter.

Second week.—Biggio spends all his time carrying the baby or crouching near Mother during the nursing periods in order to take it again. The parents seem to show no concern as to the whereabouts of the infant when they are not nursing or cleaning it. Biggio is observed crawling under the paper or blanket with the baby on his back; an action possibly prompted by jealousy as it appears to indicate a desire to keep the baby away from the others. Father is very rough when trying to get the baby off of his back. He leaps, shakes himself, and rubs against the sides of the cage. Baby found clinging to the cage bars after being pushed off by Father; it cried piteously till rescued by Mother.

Baby now turns its head in all directions. Its eyes follow the movements of the other marmosets. It is developing a louder cry of hunger and distress. This cry brings Mother to the baby. Even Father, when he hears the cry, will take the little one to Mother for feeding. Baby growing, but its color remains very dark; body almost as large as that of Biggio. Baby makes no effort to stand on its own legs. It is probably carried by its nurse about 8 hours daily.

Third week.—Baby definitely recognizes Biggio's back, and, when other animals are nearer to it, crawls over them to get to its nurse. Eyes are very bright. They react to noises. The rings on the tail are growing lighter and more marked. Baby makes clumsy effort to groom the nurse's coat. They nuzzle each other affectionately. Attempts at play are noticed; the baby leaps around on nurse's back without touching the floor. At the end of the third week it ventures to place its feet on the floor while clinging safely to the nurse with its hands; it slaps playfully at the others and grabs for specks on the floor. Movements definitely better coordinated.

Fourth week.—Baby is encouraged to stand on its feet by Mother who rolls it off her own back quite gently. It begins to crawl around, much to Biggio's worry. He soon invites it back to him or even grabs it. Parents still nurse and cleanse it. Baby will crawl several inches to get on Biggio again. Gnawing sound heard when the baby bit a perch. Baby grooms itself more vigorously and is getting very playful with the other marmosets. It is developing an unusual top-knot between its ears. This tuft is formed by the converging of the hairs to a central spot. Baby nurses more frequently and is encouraged to crawl around even to the point of being deserted by all and watched from a distance until its cries of distress become too appealing and some one comes to the rescue. Baby now swings from the perch with ease with one arm and leg while it grooms itself with the other leg or arm. Once the writer tried to rescue the baby, left hanging from the roof of the cage and apparently in distress; she was bitten by Biggio for her pains. Baby makes no attempt to take banana placed within easy reach.

Fifth week.—Baby growing steadily and moving more rapidly, making sharp turns if necessary; color still uniformly dark. Found sitting on its haunches chewing a piece of roast beef with the utmost relish. Licks a grape; makes the most amusing attempts to eat a meal worm. The worm proves to be too slippery and the attempt ends in complete failure. Baby grooms Biggio more thoroughly than heretofore.

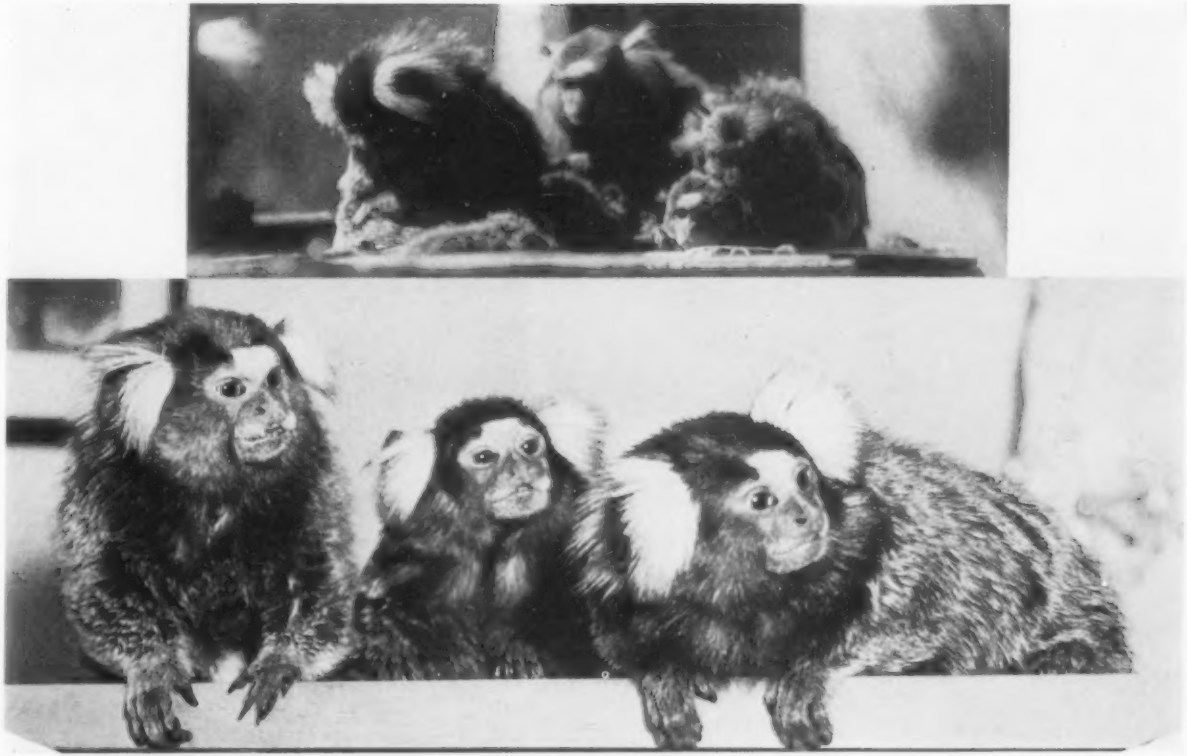

PLATE 4

PORTRAITS OF MARMOSETS

Above: Mother, Father, Biggio with one of the twins. Below: Tweedledum, Minor, Mischief (courtesy New York Sun)

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Sixth week.—Color around face becoming a little lighter because of the appearance of new lighter hairs. Baby very independent and exploring all parts of the cage; performs acrobatic feats on the perches but is very reckless when leaping around; evidently unable to measure distances properly. Prefers meat to other foods and refuses milk. Is quite unafraid of humans. Baby cries a great deal, seemingly because it has suddenly discovered that it can make sounds. Baby dislikes to go to bed at night. It may require the combined efforts of the whole family to get it into the sleeping quarters; or Mother may place her arms around the baby and lead it to bed.

Seventh week.—Hair growing longer. Mane-like shoulder piece is taking more definite shape. Mind very active as shown by keen attention to surrounding events, to distribution of food and to noises or disturbances in the room. Coordination of movements much better; more care shown in leaping; physical activities almost of adult type; plays hide and seek with adult marmosets and with people, hiding behind ledges or pieces of paper and peeping around to see if it is being watched. Can leap five inches with ease. Although able to move around freely, the baby spends all its resting hours on Biggio's back. Baby takes milk from a medicine dropper, and grapes and banana from the hand; laps up the peach juice in which the viosterol is served; rarely wants to nurse.

Lapping up liquids had to be learned. Both Mother and Biggio have been seen to call the baby (a special rapidly repeated twitter is used at such times) and then apparently demonstrate to it from the dish. Learning to drink was very difficult at first.

Eighth week.—Mother seems to watch carefully when the baby is handed any food. She comes up and tastes it and utters the little inviting cry for the baby to eat. (This seemingly protective action was discontinued soon after this time.) When Mother has a tidbit that she wishes to share with the baby she utters the special call and then gives the food to the baby with her own hand.

Third month.—Face a little lighter in color; hair longer on head and neck; ear tufts taking on a silvery sheen. No longer nurses; eats everything; still rests on Biggio.

Fourth month.—Baby stays off the nurse's back more and more but always rushes back when frightened. Mischief seen playing with it but the game gets too rough for the young one as the sister is twice its size. Baby develops the "scolding sound" and uses it as a new toy. Any new sound it utters seems to be a source of so much interest that the new sound is often repeated.

Fifth month.—Hair growing longer rapidly; ear tufts shaping around the ears; face paler and more natural looking; white spot on forehead dimly outlined; topknot conspicuous. Physical condition seems excellent.

Sixth month.—Uneventful progress; the baby is quite wilful and deserving of Mother's gentle cuffs.

Seventh month.—Increase in length seems to be at a standstill but the baby grows broader and heavier; looks rather stumpy. This was later explained by the fact that the baby is really a dwarf (and therefore appropriately called "Minor") though its growth was not checked until the last part of its first year. Extremities seem too large in proportion to body; this marmoset eventually became very timid and rather retarded in its reactions.

FURTHER HISTORY OF THIS GROUP

April 5, 1933.—Mother gave birth to large, well formed, living twins; the record shows their early history to have been very much the same as the one just described in detail, but with this difference that the physical and mental development of the twins continued uninterruptedly. Biggio again acted as nurse, but this time he had to carry a double load. The twins soon outgrew their nurse's back. They would then place on the back as much as possible of their forequarters, and let the rest of their bodies lie on the floor. Biggio at times entirely disappeared from view under his burden.

September 20, 1933.—Mother gave birth to stillborn twins fully developed and unusually large; much more blood was lost than at previous births; no trace of placenta found. Both parents tried to clasp the dead bodies to themselves and seemed puzzled that there was no reaction to their efforts; these, like the other offspring, were born at night. No objection was made when the writer removed the two bodies; and the parents seemed to forget all about them at once.

November 27, 1933.—After the marmosets had gone to bed and all the lights were out, a very unusual sound was heard. Investigation showed that a fight was in progress in the bedroom. On putting in her hand, the writer found and drew out a clinched mass of very angry animals which proved to be Father and Biggio. Biggio was taken out and quieted down. He was then returned to the cage; but again he and Father rushed at each other. Biggio was then placed in a separate cage for the night in the hope that all would be forgotten by the next day. However when he was returned to the family cage, fighting was resumed. After this, Biggio was kept for ten days in another cage in the same room with the rest of the family. It was noticed that the two males, throughout this period, kept constant watch on each other.

During one moment when the writer had left the room while cleaning the cages, Father rushed into Biggio's cage and attacked him again. After this trial of waiting for the feud to blow over had ended in failure, it was decided that one male or the other would have to be sacrificed. The decision was a hard one to make. On the one side was Father, much older and never a real pet; on the other was Biggio, a much younger, relatively affectionate animal and apparently not the aggressor. Neither could be given away to pine in solitude. So the writer decided to give Father a painless death in a lethal chamber. When she returned from "the sacrifice" she placed Biggio again with the family and carefully observed events. For a moment or two, Biggio looked around anxiously as if expecting Father to pounce upon him; but when he found he was safe, he decided that it was time for him to assume the rôle of leader of the group. For several days he strutted around, walking abnormally high on his hind legs, with his hair bristling from the top of his head to the tip of his tail. Apart from this unusual walk Biggio led a perfectly normal life. He soon seemed to have forgotten Father entirely. So did the others. They were never seen looking for him. The new leader began to pay attention to Mother but these actions were deeply resented by her. She scolded and cuffed him without mercy until Biggio gave up the hope of winning her. Then the two became great friends.

FINAL NOTE

Mother is now (November, 1934) in better physical condition than she has ever been. She shows no signs of advancing years. It is believed that she would mate again but evidently not with Biggio. One of the most puzzling facts is that Biggio, from the moment of his assumption of leadership, took a most sudden and violent dislike to the writer. He now tries to attack and bite her whenever he can. So far as she is concerned, he has undergone a complete change from the sweet tempered pet to the violently vicious enemy.

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NOTES ON THE BEHAVIOR OF NORWEGIAN BEAVER

By Alexander H. Leighton

The information set forth below was gleaned during a three weeks visit to Norway in August, 1933. The object of the trip was chiefly a holiday, but I also wished to see if I could discover any interesting differences between the activities of the European beaver and those of the American animal.

I am very grateful to Professor Alfred Wollebek of the Zoological Museum in Oslo for his kindness in helping me find the best beaver country and introducing me to Mr. Peder Jenssen, my host and guide in the field. I further wish to express my gratitude to Mr. Jenssen for perpetual effort on my behalf; also to thank our interpreter, Mr. Peder Fiskvatn.

Jenssen's farm, in the vicinity of which I made all my field notes, is in the township of Aamli in the province of East Agder in Southern Norway. Beaver have been in this district since the beginning of historic times. Jenssen has studied them both in the wild state and in captivity for many years. Although he has never bred the animals, he makes a business of catching them and selling them to parks and zoos and for repopulating depleted areas.

NORWEGIAN BEAVER CONTRASTED WITH THE AMERICAN

According to Collett (1897) the Norwegian beaver sometimes has an entrance on the land side of the lodge, generally covered with a layer of earth or twigs. Apparently the lodge built as an island in the water is unknown—I did not observe one; Jenssen had neither seen nor heard of such a structure, and Collett, although he describes various forms of bank houses, does not mention it. Salvesen (1928) says they do not exist.

I was told by Jenssen that while the beavers eat waterlily roots, they do not touch the leaves. On the lakes I noted many leaves floating about that had apparently been bitten off, but not consumed.

One morning two adult male beavers that Jenssen had in captivity were taken to a stream in the woods for the purpose of making moving pictures. As soon as both animals were liberated a remarkable scuffle ensued, the like of which I had never seen before, (nor had Jenssen, so this may not be anything peculiar to the Norwegian beaver). The cause was perhaps a small hollow in the bank just large enough for one animal and upon which both had intentions. They stood facing each other on their hind legs and without any attempt at biting, scratched and clawed each other's faces with their forepaws. One beaver hissed and the other made a faint cry a few times. The squabble lasted several minutes, then one beaver went away. Jenssen said that his beavers frequently fought very fiercely in captivity and with considerable skill and savage intention. A good bit of it went on under water. Efforts were made to bite the back in the region of the kidneys. He had lost several that died from this kind of bite.

Jenssen has never seen a young beaver riding on the back of an older one.

Collett says the beaver utters but few sounds. The babies cry and the older ones make "a sort of growl." I imagine that by "growl" he means the hiss. I heard Jenssen's adult beaver make this noise. Jenssen said that the cry usually came from the little ones, but occasionally from the adults when fighting. He had not heard any other sounds.

POINTS OF SIMILARITY BETWEEN NORWEGIAN AND AMERICAN BEAVER

The house.—From Collett I get the following data: The commonest type of lodge is built very long to prevent its being completely dry in the summer when the water level is low. It is made of twigs and plastered with mud. In size it ranges up to 50 feet by 9 feet. Construction and repair are carried out in the fall. A lodge may be inhabited for 20 or 30 years. Salvesen says the beaver are likely to move on after two or three years. Jenssen gave a similar description and added that he never knew of more than one family in a house. He thinks the houses are enlarged by being eaten away on the inside and more material piled on the outside (as the muskrat is said to do in America).

The half dozen houses I saw did not present any differences from the above description. I was a little surprised to see one of them covered with mud so early in the year as the middle of August.

Jenssen showed me a beaver pond that presented an interesting picture of early house construction. The dam below the pond had been blasted and all the water drained off. In one bank, just below the old water level a tunnel led in under the ground and came to a dead end. It had originally no connection with the ground surface, but Jenssen had dug a hole through from above in order to locate its termination. On the ground surface at the spot where he dug the beavers had made a pile of sticks as if for the beginning of a house. This suggests that the beaver was going to build a house and then connect the tunnel with it as a means of entrance and exit to the pond. Is it possible that a beaver could so accurately locate the end of an underground tunnel from the surface?

Dam.—Dams were built of the same sort of material and presented the same appearance as those in this country. One I measured was 13 meters long, 1 meter high, and had a distinct bend with the convexity up stream—the only really noticeable curve of this sort I have seen. Another dam was between two rocks and measured 2.5 meters long by 1.55 meters in height.

Jenssen said that dams are numerous all over the country. Stones are frequently employed in their structure and the dam is usually made with the curve against the current. Because the animals never drain their ponds the water occasionally goes stagnant in summer. In ascending valleys the beaver builds dams as he goes, hence there is a multiplicity of ponds rising like steps on the small waterways. Collett describes the same sort of dams.

Canal.—I did not see a true canal; that is, a cut where no water previously flowed. I paced one that was obviously an excavated brooklet and found that it was 240 paces in length. At one place I found the remains of a little dam across it, apparently a lock to enable the canal to be carried to a higher level. At the time I saw the canal the lock was not needed because the main dam at the foot of the pond flooded the entire canal.

Jenssen says that canals are common and that their usual length is about 50 meters. He has seen little mountain brooks turned from their courses to fill them. Here and there along the beds of the canals are dug deep holes that provide the beaver with a temporary safe retreat under water.

Burrows.—I saw a number of burrows; I have already mentioned one that seemed to be part of a house building scheme. Jenssen believes the young beaver live in holes before they build houses. Collett and Salvesen express the same idea.

Food.—Jenssen describes the beaver's menu as follows: Summer—aquatic vegetation about the lakes; winter—trees, in order of preference: Poplar, birch, oak, mountain ash. Collett states that the poplar is the favorite.

Habits of activity.—Apparently the Norwegian beaver is very nocturnal. Collett and Jenssen both say so. During my stay in Norway I never saw a wild beaver.

Cleverness.—Jenssen described his captive animals as being slow and dull. In the wild state they call for more respect. They fill steel traps with sticks after one beaver

has been caught. Jenssen once had seven traps out in one lake and they were all filled night after night till he gave up. Sometimes the animals are inexplicably easy to catch. He occasionally uses a pit-fall. Once or twice he caught beaver in it repeatedly, even after some had dug their way out and escaped.

This sort of stupidity in the cage and shrewdness in the bush was very characteristic of the beavers I studied in Nova Scotia.

Tameability.—Jenssen said his animals very quickly reached the point of not minding his presence, but he never had any that showed affection. The most friendly were some very young kittens, but they were sent away to a park before they grew up.

Cloaca.—Biting of the cloacal orifice was a common and puzzling habit of my beavers in Canada. When I asked Jenssen about this, he said he had seen the adult animals do it a few times, but never the little ones.

Breeding.—The young are born in May and June according to Collett and Jenssen. Nothing is known of mating season or period of gestation.

Brushing.—Brushing is done in the same manner and to the same extent as by the American animal.

Tail slapping.—I saw Jenssen's captive beaver slap the water with their tails in the usual way when disturbed suddenly.

SUMMARY

Very little difference in behavior between Norwegian and American beavers was observed or elicited by questions and reading. The following minor points were noted:

1. A terrestial door to the beaver lodge.
2. No lodges of the island type.
3. Lily-pads are not eaten.
4. Peculiar mutual face scratching scuffle between two adult male beavers.
5. Young not seen to ride on older animal's back.
6. Fewer voice sounds heard.

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FOOD HABITS OF MID-WEST FOXES

By Paul L. Errington

The studies of the past five years (1929–1934) on the food habits of foxes in Wisconsin and Iowa have been conducted in response to a very evident need of sound information on this highly controversial subject. For while opinions abound—ranging to all extremes, one way or another—actual data have not been abundant, especially as to the status of foxes as predators upon game, poultry and stock.

Previous data include chiefly the results of stomach examinations on file at the U. S. Biological Survey, Washington, D. C., from the country at large, some from Virginia (Nelson, 1933), from New York and New England (Hamilton, 1935), and fecal analyses carried on at the University of Michigan (Dearborn, 1932).

This paper (No. J. 205, Iowa Agric. Exper. Station, Project no. 330) is based on data obtained from examination of stomachs of 236 Wisconsin and Iowa red foxes (*Vulpes fulva*) and gray foxes (*Urocyon cinereoargenteus*), collected items from 113 Iowa red fox breeding dens, and 1175 Iowa red fox spring and summer fecal samples. The 1933–1934 winter stomachs and the 1934 spring and summer den and fecal specimens on hand have not yet been examined, so the scope of this paper covers broadly the laboratory and field work of four winters, one spring, and the early part of one summer.

SOUTHERN WISCONSIN STOMACH ANALYSES

The Wisconsin stomachs were from animals killed by hunters, largely in Dane, Sauk, Columbia, and Iowa counties. These were collected so far as possible from areas kept under regular observation in connection with the Wisconsin Coöperative Quail Investigation (Errington, 1933a) or from equivalent environmental types. The 1929–1930 and 1931–1932 analyses were handled personally; those for 1930–1931 by the U. S. Biological Survey.

Of my own analyses, those for the first winter are least reliable, as they represent mainly winter food items noted from hasty examinations of stomach contents, often in the field. Allowances should also be made for certain natural imperfections in the results of stomach examination as well as for my own crudities in technique. Foods are differentially resistant to digestion or are retained in the stomach for variable periods of time; carrion is picked up here and there; ecological information relating to individual stomachs is usually absent. All these elements of uncertainty add to the difficulty of obtaining a fair understanding of the predaceous activities of the species.

RED FOX

Food items found in 25 of the 46 red fox stomachs, taken between December 14, 1929, and February 17, 1930 (21 stomachs were empty or otherwise unproductive of data): Cottontail (*Sylvilagus*), in 9; fox squirrel (*Sciurus niger rufiventer*), 1; meadow-mouse (*Microtus*) (a total of about 73), 19; deer mouse (*Peromyscus*), 1; unidentified mouse-like mammal, 2; unidentified mammalian carrion, 1; domestic chicken, 2; small unidentified feathers, 2; cartilage from a large bone, 1; eggshells (from garbage), 1.

Food in 10 of the 13 red fox stomachs, taken between October 26, 1930, and February

23, 1931: Cottontail, in 4; Norway rat (*Rattus norvegicus*), 1; meadow mouse (total of about 25), 8; deer mouse, 1; domestic chicken, 1; small bird, 1.

Food in 11 of the 14 red fox stomachs, taken between December 14, 1931, and February 3, 1932: Cottontail in 9; flying squirrel (*Glaucomys*), 1; meadow mouse, 1; deer mouse, 1; unidentified mouse-like mammal, 3; domestic chicken, 3; mass of dirt and feather butts, 1.

GRAY FOX

Food items found in 17 of the 28 gray fox stomachs, taken between December 15, 1929 and June 8, 1930: Pig skin (probably carrion), in 1; cottontail, 6; fox squirrel, 1; meadow mouse (total of about 64), 15; deer mouse, 3; unidentified mouse-like mammal, 4; unidentified mammal, 1; domestic chicken, 1; unidentified feather shafts, 1; snake (*Heterodon*), 1; apple, 3.

Food in 22 of the 39 gray fox stomachs taken between December 22, 1930, and March 17, 1931: Cottontail, in 15; fox squirrel, 1; woodchuck (?), 1; muskrat (*Ondatra*), 1; meadow mouse (total of about 19), 8; deer mouse, 2; unidentified mouse-like mammal, 1; blue jay (*Cyanocitta*), 1; quail (*Colinus*), badly digested foot, 1; apple, 2.

Food in 33 of the 44 gray fox stomachs taken between December 14, 1931, and February 16, 1932: Pig skin (probably carrion), in 1; cottontail, 29; meadow mouse (total of 17), 2; deer mice (total of 10), 3; unidentified mouse-like mammal, 1; unidentified mammal, 1; small bird, 1; domestic chicken, 6; ruffed grouse (*Bonasa*), (foot), 1; carrion, 1; grapes, 1; haws, 1; apple, 7.

Feces from the intestine of one gray fox showed buds, possibly the crop contents of another ruffed grouse.

The red fox in the Wisconsin observational areas preferred to hunt principally—not entirely—in plowing or stubble fields where meadow mice were most abundant; the gray fox was more of a hunter of brushy hills and gullies where rabbits and gallinaceous game were more likely to be found. The tabulations, however, do not show the differences in diet that a consideration of the hunting habits of the two species would lead one to expect. Though quail and ruffed grouse remains were found in gray fox stomachs only, it is plain enough that both species ate about what they could get.

Fruits, notably frozen apples, were eaten in varying quantities, and one red fox was shot when snooping about a garbage pile (stomach contents: Cottontail, egg shells, cartilage from end of a large bone, feather butts).

Carrion, particularly dead domestic chickens that farmers scatter over their fields with the manure, appeared to be quite acceptable throughout the winter months. I think it probable that most, or all, of the domestic chickens represented in the stomachs—usually by feet—were carrion, for live chickens were quite closely confined to farm yards at this season. With respect to carrion wild life, it is virtually impossible to say from stomach examination whether the creatures were killed and cached, to be eaten later, or were found dead in the first place. We can hardly say, either, into how many fox stomachs parts of a given small or medium-sized carcass, killed or carrion, will find its way before it is finally cleaned up.

The listed items reflect consistently the relative availability of prey. In 1929–30, when meadow mice were exceedingly abundant, they constituted staple diet; in 1930–31 the meadow mice had fallen off decidedly, and cottontails suffered more; in 1931–32, with rabbits easily available, the fox diet was predominately cottontail. During the first two seasons the composition of the diet fluctuated with the depth of snow on the ground, the foxes turning to rabbits whenever the snow afforded the smaller prey too much protection. Worthy of comment also was the conspicuous preponderance of comparatively slow prey in the fox diet; there was hardly any representation of animals that could be considered as swift.

IOWA STOMACH ANALYSES

The Iowa stomachs represent almost entirely specimens obtained from hunters during the winter of 1932–1933 by deputy wardens, especially J. C. Jago, John Holst, Jr., and A. F. Meier. Some June stomachs were also secured by Holst. Analyses were made by myself, with the aid of a fair reference collection.

All but 2 of the 52 stomachs were of red foxes, so the data may be conveniently lumped:

Food items found in 40 of the 50 red fox and 2 gray fox stomachs, taken between December 17, 1932 and June 13, 1933: Cottontail, in 27; fox squirrel, 1; Franklin ground squirrel (*Citellus franklinii*), 1; striped ground squirrel (*Citellus tridecemlineatus*), 2; meadow mouse, 27; deer mouse, 20; harvest mouse (*Reithrodontomys*), 1; unidentified mice, 2; skunk (including 1 identified as *Mephitis*), 2; short-tailed shrew (*Blarina*?), 1; unidentified mammal, 2; icterine bird, probably grackle, 1; ring-necked pheasant (*Phasianus colchicus torquatus*, including 1 probable small chick), 4; domestic chicken (only represented by traces in 5 and by probable carrion in 1), 7; unidentified birds, 3; much insect material, 3; much vegetation (green grass), 1.

Of the stomachs and intestines containing insects in quantity, one contained 102 heads of *Phyllophaga* (June beetle) larvae; another, 21 *Phyllophaga* and click beetle (*Melanotus*) larvae; and the last, 9 Lepidoptera larvae.

The domestic chickens represented in the stomachs from Iowa, where it is not the general practice to keep chickens closely confined in winter, probably are not carrion to so great an extent as those from Wisconsin. Feet of chickens and pheasants in stomachs, however, are notably indicative of carrion feeding, as field studies revealed a decided tendency on the part of foxes to bite off and swallow the frozen feet of carcasses encountered.

Nevertheless, it does not follow that some items, even though eaten as carrion, may not represent killed prey, as an example may illustrate. A fox was known to have killed a pheasant hen beside a highway and to have left it uneaten, perhaps frightened by traffic. The next night the carcass was visited by a fox that ate the feet. This shows how the behavior of a species may complicate immeasurably one's efforts to study with accuracy its food habits; feet of fox-killed pheasant carrion can not be distinguished in a stomach from feet of motor traffic victims.

Winter studies of quail on Iowa and Wisconsin observational areas disclosed a variable fox pressure on this species, the heaviest loss definitely traced to this cause being 4 of 177 birds in the course of the season. I believe it improbable that fox depredations upon adult vigorous bob-whites often exceed two or three percent of the wintering quail population except where the carrying capacity of the land for bob-whites is exceeded. If a vulnerably situated winter bob-white surplus is present, something tends to reduce it, irrespective of fox or other predator kinds and numbers (Errington, 1933 c; 1934). Therefore, whether the exposed excess is taken by foxes or by something else appears to be inconsequential.

DEN STUDIES

Apart from some rough notes (unpublished) on 3 South Dakota dens in 1921 and a few old Wisconsin dens in 1930–1931, I had acquired very little first-hand information as to spring food habits of foxes until 1932. In 1932, the Iowa Fish and Game Commission, coöperating with the State College, instructed its deputy wardens to gather material from the vicinity of occupied dens and made special assignments of picked wardens to assist in the studies. The careful coöperation of Supervisor of Game and Deputies, William Schuenke, and Wardens Ross W. Moses, John Holst, Jr., and A. F. Meier, was of particular value.

Practically all specimen material from dens, with the exception of rabbit remains, was examined by me either in the field or in the laboratory. The wardens, whenever possible, made notes on the number of rabbits and kept representative portions of other kinds of prey, to have identification confirmed. The listed items, then, truly represent the fox food refuse that was found outside of dens or in dens dug out, although, as will be shown later in this paper, they do not represent a true cross-section of fox food habits.

Food items found in and about 113 red fox dens in Iowa during spring and early summer, 1933: Two-months lamb, probably carrion, 1; small pigs (including 3 known to be carrion, as many of the others probably were), 19; cottontail (less than full number, as some wardens made no counts of individuals), 269; jack rabbit (*Lepus townsendii campanius*), 72; unidentified rabbits, 15; woodchuck, 4; fox squirrel, 5; Franklin ground squirrel (*Citellus franklinii*), 15; striped ground squirrels, 11; specimens reported as "gophers," 4; and "squirrels," 3, both probably ground squirrels; muskrat, 2; Norway rat, 1; pocket gopher (*Geomys*), 13; meadow mouse, 6; deer mouse, 55; specimens reported as "mice," 21; striped skunk (including 1 very small *Mephitis*), 4; weasel (*Mustela*), 5; spotted skunk (*Spilogale*), 2; mole (*Scalopus*), 7; *Blarina*, 2, small opossum (*Didelphis*), 1; crow (*Corvus brachyrhynchos*, probably killed by crow shooters), 8; Icterine birds (including 10 meadowlarks (*Sturnella*), 2 grackles (*Quiscalus*), and 1 red-winged blackbird (*Agelaius*), 15; robin (*Turdus migratorius*), 5; catbird (*Dumetella carolinensis*), 1; small passerine birds (including 1 house wren (*Troglodytes*), 1 short-billed marsh wren (*Cistothorus*), 2 horned larks (*Otocoris*)), 29; long-eared owl (*Asio wilsonianus*), 1; juvenile great horned owl (*Bubo virginianus*), 1; domestic pigeon, 2; mourning dove (*Zenaidura*) 8; domestic chicken (including at least 1 known to be carrion), 69; Guinea hen, 2; ring-necked pheasant (including 201 identified as hens and 98 as cocks), 314; Hungarian partridge (*Perdix perdix*), 8; bob-white, 1; American bittern (*Botaurus*), 1; Canada goose (*Branta canadensis*), 1; Pekin duck, 1; domestic mallard, 1; mallard (*Anas platyrhynchos*, including 2 believed to be semi-domesticated), 3; pintail drake (*Dafila acuta*), 1; blue-winged teal (*Querquedula discors*), 1.

It may be seen by checking over the items identified from dens that they constitute principally remains of medium-sized prey, i.e., rabbits, poultry, and miscellaneous species of comparable size. Small mammals notably—while strongly predominant in half or more of the feces—do not accumulate in very conspicuous numbers but are apparently eaten whole. On the other hand there is much tough or inedible material about the larger carcasses that the foxes do not clean up and which persists indefinitely, even for years.

A considerable amount of material seemingly is carried to dens with no very evident intention of using it for food. The fox pups frequently use for play purposes objects obviously unsuited for food, as blocks of wood, horse feces, and time-bleached bones from stock carcasses. Hard ear-corn may be used both for play and for food. All the weasel carcasses that I examined were putrid and entire. Pig and chicken carcasses picked up in the first place as desiccated carrion in winter or early spring were frequently deposited at the dens, to be left there uneaten.

Fragments of larger prey species, as well as wings of small birds and entire small mammals, were scattered about the outside of most dens. My casual impression is that examination of the outside litter gives nearly as reliable an index to the representation of foods as could be obtained through digging out of the dens. Dug out dens, though, in several cases yielded considerably more material than was evident at the surface.

ANALYSIS OF IOWA FOX DEN FECAL SAMPLES

Coincident with the gathering of prey refuse from the Iowa dens in 1933, fecal samples were taken. The feces could usually be picked up near the entrances of the dens or

about the periphery of the dirt mounds commonly present. Fecal samples totalling 1175 were obtained from 82 of the 113 dens, with lots ranging in size up to 119.

The entire collection of 1175 fecal samples was analyzed personally. The tedious and time-consuming nature of the job combined with the pressure of my other official duties, did not permit me to pay a great deal of attention to individual samples. Hence a certain amount of omission and questionable identification of items in the analyses may be taken for granted. I regard the determination of the common items, however, as furnishing a sufficiently correct analysis of the bulk of the fecal substance examined.

Species representation in 1175 Iowa red fox fecal samples, spring and early summer, 1933:

Feces containing mammal remains: Small pig bristles, 6; cottontail in quantity (represented by fur, 492, and by bones, 79), 505 total; more or less satisfactorily identified jack rabbit, 26; Leporidae, mainly unidentified juveniles, 141; woodchuck (?), 1; Franklin ground squirrel, 16; striped ground squirrel, 23; undertermined, probable ground squirrels, 17; meadow mouse in quantity (represented by fur, 499, and by bones, 191), 515 total; deer mouse (represented by probable fur, 85, and by bones, 65), 104 total; harvest mouse, 3; jumping mouse (*Zapus*), 3; house mouse, 1; Norway rat, 4; undertermined mice (represented by fur, 117, by bones, 32), 136 total; pocket gopher, 21; spotted skunk (*Spilogale*), 1; mole (*Scalopus*), 5; *Blarina* (?), 1; prominent unidentified mammal remains, 35; conspicuous unidentified bone fragments, 19.

Feces containing recognized bird remains, other than poultry and pheasants: Crow, 1; meadowlark, 15; grackle, 3; red-winged blackbird, 1; robin, 2; horned lark, 1; unidentified small birds, probably passerines, 31; flicker (*Colaptes*), 1; domestic pigeon, 1; mallard duck (probably tame), 1; bob-white, 9; Hungarian partridge, 1.

Feces containing representation mainly of poultry and pheasants:

(a) Fair determinations of domestic chickens: considerable quantities in 9 fecal samples; evident quantities in 5; traces in 2.

(b) Determinations of domestic chicken listed as possible or probable; considerable quantities in 4 fecal samples; evident in 4.

(c) Total listed representation of domestic chicken, including doubtfuls, 24.

(a′) Fair determinations of ring-necked pheasants: considerable quantities in 31 samples; evident, 14; trace, 5; by bones only, 4.

(b′) Possible or probable pheasant determinations: considerable quantities in 6; evident, 5; trace, 1.

(c′) Total listed representation of pheasants, including doubtfuls, 66.

Feces containing avian material, about 410 samples, included: Unidentified gallinaceous birds, 3; medium sized unidentified birds, 5; unidentified feathers in 248 samples (considerable quantities in 74; evident quantities in 97; traces in 77).

Miscellaneous fecal contents: Egg shells (including 2 probably of pheasant) in 5; piece of leather, 1; frog (*Rana*), 2; snake, 2; insects in 93 (large numbers in 29; moderate in 10, apparent representation in 54).

In addition to those arising from the short-comings of my own analytical technique, several further valid criticisms may be brought against these studies of feces. While the stomach examination method of research may not give us complete information about food habits and may be in need of interpretation, fecal analyses need to be supplemented and interpreted a great deal more.

Adult jackrabbit probably is not represented in the feces in anywhere near the proportions in which it is eaten, as the hide is tough and readily laid back from the edible portions of the carcass. Feathers of grown poultry, pheasants, or other large birds, although rarely eaten in bulk proportional to the size of the carcasses, are nevertheless taken rather freely; but digestive action has a way of wearing most of these feathers down to virtually unidentifiable shafts and butts. The more clean meat there is in the

diet, of course, the less identifiable material will show in the feces, which in many instances are little more than an amorphous mixture of dirt and gummy or hardened protein waste.

The irregular passage of food debris in the feces, too, needs always to be considered. We have not checked up this point experimentally with live animals, as Dearborn (1932, pp. 14–15) did with the mink, but the examination of some hundreds of mammalian predator stomach and intestinal contents, mainly of house cats and foxes, has emphasized its importance. Very frequently a residuum of long retained indigestible material is noted in a stomach along with foods of fresh or recent ingestion; this stomach residuum commonly contains such items as worn feather butts, teeth and claws, soles of feet, particles of gizzard lining, coarse hair, chicken leg scales, etc. Such materials are also found distributed throughout the length of the intestines, presumably passed in from the stomach, bit by bit, over variable periods of time.

When one considers the likelihood that resistent particles from a given individual of prey may be represented in feces for days, it becomes apparent that mere representation leads to the placing of excessive emphasis on certain prey types. Traces are important in *qualitative* food habit studies but the dangers of using them in *quantitative* work should not be overlooked. The danger of over-emphasizing traces is especially great in the organization of data from fecal samples found at dens; the activities of the pups break up and mix the feces so inextricably that the evidence is greatly obscured.

One lot of 10 fecal samples contained bob-white remains in 5, but a scrutiny of the analyses reveals how bone fragments from one bird might easily be spread through a large number of feces. One sample contained a quail femur end; the second, a left humerus end and fragments of both coracoids; the third, feathers and synsacrum fragments; the fourth, a right humerus, foot and sternum fragments; and the fifth, a maxilla and fragments of femur, sternum, and coracoid.

CORRELATION OF DEN STUDIES AND FECAL STUDIES

In view of the obvious short-comings of the sundry investigational techniques tried for foxes, it seems that the soundest procedure is to rely upon no single technique but use critically all of the methods available. For mid-west winter studies, it may be best to rely on stomach and fecal analysis in conjunction with field observation and ecological study of the animals preyed upon by foxes; during spring and early summer, a combined technique of den and fecal studies is desirable. For late summer and autumn no particular technique appears to be especially promising, though something may be learned from stomach analyses and from the examination of prey caches. Stomach analyses are doubtless best for general food habits research.

Let us inquire into the feasibility of correlating the spring and early summer den and fecal studies. Spring and early summer may be jointly regarded as a period when fox depredations upon prey species are accelerated by the growing requirements of pups in dens, and also a period when heavy pressure upon many prey populations is borne by breeding individuals. Hence this period probably has special biological significance.

The gross discrepancies in ratios of prey species evident at dens and their representation in feces are very apparent. Of 910 individuals of prey recorded for the 113 dens, 473 or 52 per cent were birds, whereas only 36 or 3 per cent of the 1175 fecal samples from the same dens consisted mainly of recognizable avian material. The fecal samples containing some recognizable avian material totalled about 410, or 34 per cent, of which only about 190 or 16 per cent contained any considerable amount. Mammalian material on the other hand comprised nearly all of the remaining 1139 or 97 per cent of the total fecal samples.

From table 1, we may see that relatively few species show comparable representation in both den débris and feces, namely: Cottontails, ground squirrels, white-footed mice,

pocket gophers, moles, and passerine birds. The birds are largely species the wings of which may be nipped off at the den and the rest eaten whole; the mammals are largely those of such size as to be entirely devoured, but of which some portions are apt to remain scattered about near the den. Exceptions are weasels, which are brought in and apparently not eaten, and meadow-mice which are well represented in feces but hardly at all in the den refuse. Domestic chickens appear more equally represented in

TABLE I

Comparison of incidence of prey species in 910 specimens at dens and in 1175 fecal samples

PREY	DEN REPRESENTATION	DEN SPECIMENS (PERCENTAGE)	FECAL REPRESENTATION	FECAL REPRESENTATION (PERCENTAGE)	INCIDENCE RATIO, DEN:FECES
Small pig	19	2.1	6	.51	4:1
Cottontail	269	29.6	505	43.0	3:4
Jackrabbit	72	7.9	26	2.2	4:1
Unidentified Leporidae	15	1.6	141	12.0	
Franklin ground squirrel	15	1.6	16	1.4	Citellus
Striped ground squirrel	11	1.2	23	2.0	1:1
Unidentified ground squirrel	7	.8	17	1.4	
Pocket gopher	13	1.4	21	1.8	1:1
Microtus sp.	6	.7	515	43.8	1:75
Peromyscus sp.	55	.6	104	9.0	2:3
Unidentified mice	21	2.2	143	12.2	
Norway rat	1	.1	4	.3	
Woodchuck	4	.4	1	.1	
Skunk	6	.7	1	.1	
Weasel	5	.6	0	.0	
Mole	7	.8	5	.7	2:1
Crow	8	.9	1	.1	
Meadowlark	10	1.1	15	1.3	Miscellaneous passerines
Icterine birds	5	.6	4	.3	and Icteridae
Miscellaneous passerines	29	3.2	34	2.9	1:1
Columbiformes	10	1.1	1	.1	
Hungarian partridge	8	.9	1	.1	
Bob-white	1	.1	9	.8	
Pheasant	314	34.5			
Total, including doubtful			66	5.8	6:1
Strong representation			37	3.2	11:1
Domestic chicken	69	7.6			
Total, including doubtfuls			24	2.0	4:1
Strong representation			13	1.1	7:1

den refuse and in feces than pheasants, though both birds are plainly over-represented at dens, as are jackrabbits and other rather large mammalian prey.

For small forms such as mice and passerine birds, which are swallowed whole or nearly whole, substantial representation in feces may mean approximately one individual. A tender young rabbit, on the other hand, if eaten entire, may furnish enough fur to be detected in many fecal samples. In the absence of data from feeding experiments, then, I doubt if attempts at correlating den-feces ratios would be worth while.

Data from a single typical den are sufficient to exemplify these difficulties. Den no. 93 had near it the remains of 1 small pig, 1 fox squirrel, 3 cottontails, 1 weasel, 2 crows, 1 domestic chicken, 3 pheasants, and 1 American bittern. Of 119 fecal samples collected at this den, 2 contained small pig; 31, cottontail; 1, jack rabbit; 2, unidentified Leporidae; 1, woodchuck; 1, ground squirrel; 1, pocket gopher; 2, Norway rat; 82, *Microtus*; 6, *Peromyscus*; 1, *Reithrodontomys*; 17, unidentified mice; 1, *Scalopus*; 1, *Blarina* (?); 3, unidentified mammals; 1, domestic chicken; 9, pheasant; 26, miscellaneous and unidentified birds in greater or less quantities.

GENERAL REMARKS ON FOX FOOD HABITS

Fox food habits seem to be dependent largely on availability of prey. Small mammals evidently constitute staple foods during the greater part of the year. The representation of other kinds of prey fluctuates according to seasons, weather conditions, abundance and vulnerability of prey populations, and with the experience of the fox. Young animals learning to hunt have to take what they can get.

The rare representation of *Microtus* at dens and its high occurrence in feces, compared with *Peromyscus*, may signify a preference on the part of foxes for meadow mice.

Foxes ordinarily do not kill large prey; grown domestic chickens, cock pheasants, woodchucks, and jackrabbits appear to represent the largest creatures that they care to attack. Of course, juveniles of larger animals may be vulnerable, but items such as the two-months lamb found at one den and the calf carcasses now and then reported can hardly be anything but carrion; there surely is a limit to what may be done by an animal weighing ten or twelve pounds and possessed of neither great ferocity nor exceptionally formidable dental equipment. A cured ham that some Iowa hunters retrieved from a fox den does not indicate that a fox killed a pig!

Doubtless much of the damage to pigs charged against foxes does not represent depredation at all, but carrion feeding. Two entire fresh pig carcasses picked up by one of the wardens at a fox den showed no traces of injury; bloodless tooth marks about the nose of each indicated that they had been cold when carried to the den. Other pigs were observed in such withered, dried condition that they must have been dead for weeks before having been picked up. Practically all of the really authentic cases of depredations were those in which foxes had preyed upon small pigs farrowed under semi-wild conditions or at considerable distances from buildings.

Likewise, a great deal of the widely advertised destructiveness of foxes to poultry proves upon investigation to be overdrawn. The interest of foxes in dead chickens thrown out in fields with manure has been touched upon. A certain amount of the chicken material found at dens is known not to represent killed prey. One farmer admitted to a warden checking up a complaint that the poultry debris about a den came mostly from chicken carcasses thrown out during the winter. In another instance a farmer had watched a fox carrying to its den a number of chicken carcasses which someone had dumped beside a highway.

Poultrymen may at times, however, have a real grievance against foxes. Aside from losses of an odd chicken now and then, depredations upon vulnerably situated flocks may be severe, especially when mid-summer family groups of foxes may raid farm yards. We have authenticated instances of as many as 160 chickens being killed in two mornings by a raiding fox family. Half grown turkeys may suffer heavy losses also.

The worst depredations occurred on farms which lacked a good dog, and on which extensive concealing vegetation allowed the foxes to sneak close to the buildings. Corn fields planted right up to the farm yards furnished excellent opportunities for unobserved approach and played a prominent part in a number of poultry massacres. All in all, the majority of severe depredations seem preventable, if only through the possession of an active dog.

Fox pressure upon game birds should perhaps be divided into a number of categories. With respect to winter bob-white, fox pressure appears rather confined to that proportion of the population which the environment does not easily accommodate. Populations in excess of carrying capacity are vulnerable to predators, including foxes. Conversely, bob-white populations within or below environmental winter carrying capacity (as defined in terms of food and cover combinations or of covey territories) are, unless weakened by starvation, wounds, disease, or other causes, essentially secure against the usual types and densities of their natural enemy populations. Material depredation of foxes upon quail—at least in winter—may then be more properly regarded as a symptom of species vulnerability than a factor significantly influencing population levels (Errington, 1933 c; 1934).

The severity of depredations upon the introduced ring-necked pheasant presents questions which our available data do not answer. Specifically, does the fox pressure actually hold down pheasant population levels or does the preying largely mean only the removal of an exposed surplus, doomed anyway as in the case of quail surpluses? Unpublished data show a strong local vulnerability of the similarly alien Hungarian partridges. Exceptional vulnerability of another alien, the Norway rat, has also been noted (Errington, 1933 b; 1935).

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THE MARSH RABBIT: AN INCOMPLETE LIFE HISTORY

By Ivan R. Tomkins

[*Plate 5*]

Very little has ever been written of the habits of the marsh rabbit (*Sylvilagus palustris*), even though it is an abundant species over much of its range. It was first described by Dr. John Bachman (1837, p. 194), of Charleston, S. C., and he, in company with Audubon, prepared the fullest, indeed almost the only account of its habits, comprising six pages in "The Quadrupeds of North America" (vol. 1, pp. 151–156). Most of the recent accounts concern chiefly the technical characters and the range of the species.

The account given here is incomplete, and is but a record of the ordinary things noticed by an often too casual observer, who has lived and worked in a place where the typical subspecies is abundant. The Florida race, *S. palustris paludicola*, ranges over much of southern Florida, and is not touched upon in this account.

"The feet of the Marsh-Hare are admirably adapted to its aquatic habits. A thick covering of hair on its feet, like that on the soles of the other species, would be inconvenient; they would not only be kept wet for a considerable length of time, but would retard the animal in swimming. Quadrupeds that frequent the water, such as the beaver, otter, musk-rat, mink, etc., and aquatic birds, have nearly naked palms; and it is this peculiar structure, together with the power of spreading the toes, that enables this animal to swim with great ease and rapidity." So wrote the Sage of Charleston, and, ever since, this paragraph has been the most quoted of all he wrote about the present species.

As a matter of fact the marsh rabbit has very well-haired soles, with hairs nearly equal in length to those on the soles of the cottontails. It is the length of toe-nails that makes the tracks distinctive. A comparison of toe-nail lengths between several specimens of *Sylvilagus floridanus mallurus* and an equal number of *S. palustris* gives the latter species 13 percent longer nails on the average.

Most writers have believed that *S. palustris* never has a tail that is white below. The writer has seen several specimens, perhaps ten, out of several hundred handled, with tail pure white underneath. The tail is, however, so much shorter than in *S. f. mallurus*, that no one need make any error in identification on that score.

The region where my observations were made extends for twenty miles along the lower Savannah River, down to the salt marshes of Cockspur Island on the east, and into the freshwater marshes to the west. In the time of Dr. Bachman these freshwater marshes were ricefields, but now they have reverted to their original condition or have been subjected to such changes

as men believe will make them duck preserves. The marsh rabbit is plentiful in most of the low ground in this whole area, particularly where there is sufficient high ground to offer protection during the higher tides. At some times of the year it feeds on the higher sandhills of the coastal islands, or on the sand heaps left from dredging operations, but its normal habitat is the wet marsh, where it ranges extensively, but prefers that part adjacent to the higher ground.

Dr. Bachman considered that the greatest numbers were in the freshwater marshes, but here and now they are most numerous in certain brackish territory in the middle of the area in question.

My experience with the species has come through spending most of the winters since 1922 within this narrow strip of land. The summers are not good times for such observations, because of the heat, the intolerable hordes of insect pests, and the dense vegetation, which latter our rabbit well knows how to use to advantage.

TIME OF ACTIVITY

The marsh rabbit is essentially nocturnal, but its habit of feeding in the tidal marshes makes modification of this habit necessary, as it must move to higher ground on flood tide and back into the lower grounds as the ebb leaves them uncovered. A boy who trapped many of them in box traps there told me of catching them in the daytime within twenty minutes of setting the trap.

One, kept captive for a time in a room on the dredge, was much more active from dusk on throughout the entire night. If there was too much noise near the crate it recognized as home, it would slip out of one of the holes it had gnawed in the side, and fade into a dark corner under the desk until everything was quiet, when it would go back to the crate again.

In the wild state in winter, one started from a form will not likely be found in that form again. But there is evidence in the burned-over marshes that in summer the rabbits gather cut rushes and make platforms on which to sit—this in places not normally overflowed by the tides.

DISEASES AND ENEMIES

The writer is not competent to go into the matter of diseases, but can briefly say that no evidence of cyclic abundance and scarcity has been seen during the thirteen winters of observation. One cannot but wonder how much advantage towards health there has been in the cleansing effect of the high tides covering the salt marshes, the occasional floods over much of the freshwater area, and the fires that each winter sweep much of the higher grounds of the thicker grasses and sedges.

Most of the predators that are enemies of the cottontail will take the marsh rabbit if within their territory. Probably the vultures (*Cathartes aura septentrionalis* and *Coragyps atratus atratus*) and the eastern red-tailed hawk (*Buteo borealis borealis*), in their limited opportunities for capture of the rabbits, are more beneficial than otherwise, through weeding out unfit animals.

The great horned owl (*Bubo virginianus virginianus*) is, as is well known, a destroyer of any bird or animal it can handle; and all the larger hammocks in the salt marshes and the neighboring woods in the freshwater areas are likely to have one or more resident pairs of this species.

TRACKS OF A WALKING MARSH RABBIT IN MUD

UNIV. OF MICH.

Among the birds of prey, the marsh hawk (*Circus hudsonius*) is the rabbit's worst enemy. From late August until April there are numbers of them everywhere over the open salt and brackish country, with oftentimes a half dozen in sight at once, quartering back and forth, looking for any small animal or bird that can be taken. I have seen seven circling over a small area, on the day after a heavy marsh fire, and have many times disturbed one of these harriers from a meal on a freshly killed rabbit, or found that one of them had carried off one of the rabbits I had shot and laid up until my return trip.

The wintertime activities of the mink (*Mustela vison lutensis*), include some rabbit hunting, and on a couple of occasions a mink has come within a few feet of my position, with its nose to the ground like a miniature beagle, following the twists and turns of a rabbit's trail.

Man, with the aid of his gun, dog, and fire, easily is the worst enemy of all.

When spring comes, the marsh hawk leaves for more northern regions, the sedges grow tall and protective, man does not hunt, the hunting dogs may get the heart-worm (*Filaria*) and die, and the marsh rabbit is mostly left in peace, except for the hordes of mosquitoes and flies, the huge larvae of *Cuterebra* under the skin, and such internal parasites as may attack him.

Dr. E. W. Price of the Bureau of Animal Industry has identified two nematodes, *Dermatoxys veligera* and *Obeliscoides cuniculi*, and two tapeworms, *Citotaenia* sp., probably *C. variabilis* and *Cysticerus pisiformis* (larval), from this host.

TRACKS

Other rabbits and hares hop. So does this species on some occasions; but commonly, while quietly feeding (this observed in captives) and when walking in soft mud, the marsh rabbit steps alternately with each foot, leaving in mud an inch or so deep two alternately spaced lines of foot-prints, much like the trail left by a skunk or porcupine when walking in soft snow. This trait seems unique among rabbits. Even Seton (1929), that close observer of tracks, has not chronicled any such habit among the others. While at rest, it habitually spreads the toes of the front feet. And the long claws of both front and hind feet show plainly in the tracks.

DIGGING

Though this species does not live in burrows of any kind as a usual thing, the long toenails are used to dig holes in the sand. Bachman records the same thing. But some holes dug in wintertime are in localities where it seems no roots are to be found. Some holes measured a foot deep. All slanted down at about 60 degrees from the horizontal. The tracks show that the rabbit sits with its hind legs well spread, and paws the sand backward between them with the front feet. The holes are roughly heart-shaped in horizontal cross-section, with the indentation corresponding with the space between the front feet.

SWIMMING

By far the best known habit of this species is its liking for water. Individuals are sometimes encountered in the day far out in the river, and with no unusual tidal conditions to account for it. One particular rabbit was found swimming strongly alongside of a dredge fully 700 feet from either shore.

In summer or fall, when the water is warm, they take to it readily; but in late winter, especially on cold days, they are reluctant to swim, supposedly on account of the cold water.

Oysterbed Island, near the river mouth, and 2100 feet north of Cockspur Island, was built up of material from dredging operations during the last thirty or forty years.

There were no rabbits on the island until the summer of 1925, when some halfgrown ones were carried over from Cockspur by some men who worked on the river. Despite the fact that for several years there was none of the low wet marsh there, the species has always kept a foothold since, though burning of the cover and hard hunting made it seem at times as though all had been killed. There is probably little migration to any great distance, as a general rule, but floods in the freshwater area may sometimes cause an enforced migration.

The swimming motions are a continuation of the alternate wading step, already described.

Records of swimming rabbits, other than those in the present subgenus, *Tapeti*, seem to be scarce. William Brewster, in a letter to Dr. Merriam, as quoted by Seton (1929, p. 715), tells of a snowshoe rabbit in the water, and that it kicked, apparently much like the usual hop on shore, thrusting itself nearly out of the water. If the alternate swimming and walking motion is peculiar to the marsh rabbit and its allied species the swamp rabbit (*Sylvilagus aquaticus*), one might expect to find important differences in the muscles and nerves in this subgenus.

BREEDING, NEST, AND YOUNG

The breeding season begins earlier than Bachman states, females heavily pregnant being often found in late February; and the nest to be described later was found, with young nearly ready to leave, on February 20, 1933.

Some females taken on November 5, 1933, still had milk in the teats, and one individual was obviously sub-adult. It is not common, though, to find rabbits at this time of year not fully grown.

Inquiry of the local hunters and other persons brought out the information that the usual litter is from three to not more than five.

The nest found in February contained three young at the first visit, and four two days later (evidently one was absent on the first visit). The nest was about fourteen inches across and perhaps eight inches deep. It was composed of the softer grass blades mixed with quantities of rabbit fur, and was floored with an inch or more of the same material. Placed among burnt sedges about one foot vertically and thirty feet horizontally from normal high water mark, it was easily located by the rabbit fur, and could be seen (when one knew where to look) at least fifty feet away. Had the sedge not been burned it would not have been visible ten feet away. The nest had been occupied long enough to be dilapidated, and the alarmed young went in or out through any side.

The young were old enough to leave the nest finally four days later. The following notes were written the day the nest was found: "Occupants, three, well enough grown to be hard to catch; one got away from me; photographed the others, but had to hold them. The young have well haired feet (soles) and are dull in color, the only buffy tints showing on the outside of the feet. The tail is dull in color below and pointed. The young were very wild when out in the light; one put in the camera box thumped; all squealed when frightened—a typical rabbit squeal; one grunted when not hurt at all. All unceasingly tried to get away until I put them back in the nest, where they were when I came back a half hour later. I saw a rabbit slipping through the short grass fifty feet away, perhaps the mother. The hair in the nest was not shed hair gathered together as the grass here had burned not long ago, and it was not late enough in the spring for much natural shedding."

ECONOMIC STATUS

All the evidence at hand seems to indicate that this species is a distinct asset. It is used for food, furnishes a fair amount of sport, and does little damage to gardens, crops

or fruit trees, largely because the land occupied is waste land, particularly so since the abandonment of rice culture in the extensive marshes.

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U. S. Dredge "Morgan", Savannah, Ga.,

SHARP-HEADED FINNER WHALE TAKEN AT LOS ANGELES HARBOR

BY D. H. FRY, JR.

On February 4, 1933, a small whale was seen inside Los Angeles Harbor by a carpenter employed at a local boatworks. It appeared to be feeding on schools of small fish and was so preoccupied that the man was able to get close enough in a skiff to lasso it around the tail. For some time he was in the same predicament as the man who grabbed a bear by the tail, but finally the whale in one of its wild dashes beached itself and ended the struggle. It was then taken to a fish-freezing plant and frozen. It was in this condition when I saw it.

The whale was obviously the sharp-headed finner, *Balaenoptera davidsoni* Scammon, unless this name is synonymous with *B. acuto-rostrata* Lacépède. There are various discrepancies between Scammon's drawing and description, and True's data. True suspected that most of these differences were due to inaccuracies on Scammon's part. This appears to be the case, since whenever there is a discrepancy this specimen checks much more closely with True's description and measurements than it does with Scammon's. In any event a series of skull measurements would appear to be necessary to establish a Pacific species or sub-species. It may never be possible to take such measurements of this specimen since it was sold to a moving-picture studio, and Heaven only knows what fate is in store for it.

DESCRIPTION

Color: Uniform black above, white beneath, the two colors shading irregularly into each other on the sides. Pectoral fin black above at base and tip with a white spot extending across the middle third (measured along anterior edge) at right angles to the anterior edge, four-fifths of the way to the posterior edge of the fin. This spot or stripe is sharply defined proximally, but is vague and irregular in outline distally and posteriorly. Posteriorly the proximal edge of the white area is closest to the body, since the posterior edge of the fin is much the shorter. A reddish pink spot shaped like half a pear and apparently not due to injury is on the left pectoral at the rear of the white spot.

Ventral grooves of the chin pinkish. Seventy grooves, counting from eye to eye. (There is some branching of these grooves.) Baleen yellowish white.

Weight, 750 lbs. Sex, female.

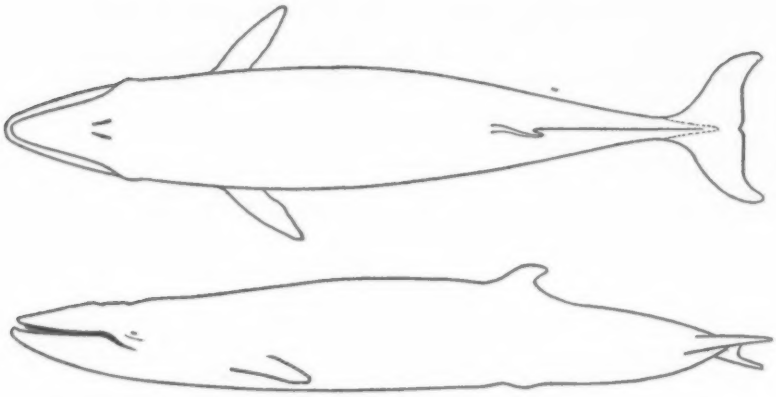

FIG. 1. DORSAL AND LATERAL VIEW OF SHARP-HEADED FINNER WHALE

When seen by the writer, this whale was frozen with its mouth forced wide open. Consequently, the exact appearance of the lower jaw is somewhat questionable, but its readjustment, based on a photograph taken at a rather poor angle, is not entirely guesswork.

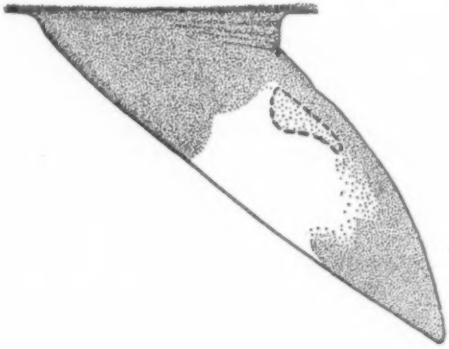

FIG. 2. DIAGRAM OF LEFT PECTORAL FIN, TOP VIEW

The area included within the dashed line is bright pinkish red on the left flipper, white on the right. The pattern of the two fins is similar, but not even approximately identical.

Measurements

			Percentage
Snout to fork of caudal	10 ft.	5in.	100.0
Total length	10	10½	104.4
Snout to anterior edge of dorsal	6	11½	66.6
Snout to posterior edge of dorsal	7	5¾	71.8
Snout to anterior edge of pectoral	3	1	29.6
Snout to posterior edge of pectoral	3	8	35.2
Snout to angle of jaw	1	8¼	16.6
Tip of lower jaw to angle of jaw	2	1	20.0
*Snout to center of spiracles	1	4	12.8
Snout to center of eye	1	10	17.6
Eye to eye over top of head	1	11⅝	18.9
Girth, just back of pectorals	5	1¼	49.0
Length of pectoral along anterior edge	1	5	13.6
Length of pectoral along posterior edge	1	0	9.6
Tip of pectoral to distal edge of white strip along anterior edge		5¼	4.6
Tip of pectoral to proximal edge of white strip along anterior edge		10	8.0
Fork of caudal to center of anus	2	11⅞	28.7
Fork of caudal to anterior end of genital slit	3	8¾	35.8
Fork of caudal to posterior edge of dorsal	3	1½	30.0
Caudal, tip to tip	2	1½	20.4
Caudal, greatest width	2	3¾	22.2
Greatest length of baleen (outer edge)		2⅝	1.9
Greatest length of baleen (inner edge)		3⅛	2.9

*This measurement may seem erroneous but it is not.

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A FIFTH ALLELOMORPH IN THE ALBINO SERIES OF THE HOUSE MOUSE

By Horace W. Feldman

The albino gene, an unusually mutable locus in several mammals, is now known to have produced, in the house mouse, *Mus musculus*, four recorded allelomorphs. Normal color (*C*), is typical of the wild form and is characterized by a full intensity of black and yellow. It is dominant over the lower members of the series. Albinism, (*c*), the lowest in the series, is recessive to the others. When homozygous it produces a mouse practically devoid of pigment in the hair, skin and eyes. Detlefsen (1921) described a third member which he called extreme dilution (c^d). This type is recessive to color and incompletely dominant over albinism. Black is reduced to a very pale brownish shade, and yellow is reduced to white, although the eyes, ears and scrotum retain much pigment.

I reported on a fourth allelomorph (Feldman, 1922) more intense than extreme dilution but considerably more dilute than full color. Since my paper was published I have observed in the literature that Schuster (1905), Plate (1910), Hurst (1911), and Hagedoorn (1912) had also reported on dilution factors of the house mouse which were very similar to members of the albino series. It is also possible that the form which I described is the same as that observed by one or more of these authors. I obtained my original stock from an animal dealer who had a considerable number of mice of this particular color allelomorph. An exact statement upon the identity of any two of these reported variations is difficult in view of the rather general descriptions which are available.

DETAILED RESULTS

Since my first account of this fourth color allelomorph I have had occasion to work considerably upon this and the other members of the series. Part of this work has been published (Feldman, 1924, Feldman and Pincus, 1926). This member was originally termed by me ruby-eyed dilution (c^r) because of its similarity to the albino allelomorph of that name reported by Whiting and King (1918) in the Norway rat. The term, pale chinchilla, would be equally appropriate and would indicate a similarity to that albino allelomorph of the rabbit described by Castle (1926) under the same name. It is roughly intermediate between full color, C, and extreme dilution, c^d. The black pigment in a homozygous c^rc^r mouse is reduced to a medium shade of sepia and the yellow is intermediate between white and the full intensity of C. The nonagouti ruby-eyed dilute mice are of a sepia shade clearly distinct from the black of ordinary nonagoutis, $aaCC$. The eye of the ruby-eyed mouse is slightly less intensely pigmented than in mice of full color at ages of less than thirty days. In adults no difference can be seen. The skin of the extremities has considerably less pigment than in full color. Ruby-eyed dilute proves to be recessive to full color and incompletely dominant over the two lower members of the series. The heterozygotes c^rc^d and c^rc are easily distinguishable. In each of them the intensities of black and yellow are approximately intermediate between those of the homozygous compounds of the allelomorphs involved.

Several years ago I was preparing for a class in Genetics some material which would illustrate incomplete dominance in a pair of mendelian characters. For this purpose I chose the ruby-eyed dilute and extreme dilute color allelomorphs of the house mouse. From a stock of each of these color types individuals were taken which were homozygous for the common variations. The progeny of a ruby-eyed male mated with extreme dilute females proved surprising by being composed of two distinct types. One type, the less intense, was the typical c^rc^d heterozygote. The other more intense type closely resembled the homozygous ruby-eyed type c^rc^r. At the time this observation was made it was assumed that a particularly potent modifying factor or factors existed in a heterozygous condition in the sire of these mice. An examination of the male showed that he was at least as intense in color as any homozygous ruby-eyed mouse which I had observed.

Subsequent matings involving this male and his unusually intensely colored offspring produced evidence that they carried a new and fifth allelomorph of albinism. This new allelomorph, which may be designated intense chinchilla, c^i, is qualitatively between full color and ruby-eyed dilute. In it black pigment is very slightly reduced. As a result the nonagouti type cannot be distinguished with certainty from ordinary nonagouti or black. Yellow pigment has a pale ochraceous yellow color, bordering on a lemon tint. Persons not accustomed to a comparison of the albino allelomorphs fre-

quently confuse the agouti, c^ic^i, mice with full color C. It would be very difficult to confuse the c^rc^r and CC types. The pigmentation of the eyes and skin at the extremities of the new allelomorph appears to be as intense as in full color.

Intense chinchilla like the other members of the series is completely recessive to full color. It also exhibits incomplete dominance over the allelomorphs lower in the series. The heterozygous combinations of this new member with the other three differ in intensity sufficiently to be distinct. However, when homozygous types are interspersed the differences between the various intensities of black and yellow become quite small. Thus the series, c^ic^i, c^ic^r, c^rc^r, c^ic^d, c^rc^d, c^ic, c^rc, c^dc^d, c^dc, and cc presents a progressive dilution of black and yellow pigment in which each step is so small that in some instances it is almost imperceptible. This is especially true of the yellow pigment which is already drastically reduced in the most intense compound. Among adult mice the black pigment undergoes most drastic reduction in the eyes when the higher allelomorphs are entirely dispensed with and the homozygous albino is secured. In house mice, therefore, with the exception of complete albinism, the albino allelomorphs do not reduce the eye pigment to any considerable extent. In this respect the mouse differs markedly from the Norway rat, the guinea-pig and the rabbit. It is evident also that the mouse differs greatly from the guinea-pig in showing a close parallel throughout the series in the reduction of both black and yellow pigments.

The various degrees of reduction of the pigments by the several albino allelomorphs have been observed in the absence of other diluting factors, that is, in material in which they were the only departures from the complex pattern of the wild-type pigmentation. They have also been observed in conjunction with several other color characters which would tend to emphasize their effects upon the coat color. Non-agouti prevents the development of yellow in practically the entire coat, thereby emphasizing the degree of intensity of the darker pigments (black and brown). Yellow, the dominant member of the agouti series, in some strains prevents the development of black or brown pigment and thus emphasizes the condition of the yellow. In a similar way pink-eyed dilution eliminates much of the darker pigments leaving an essentially yellow coat color and pink or almost pigmentless eyes. In the following table is presented a very general description of the color of the hair when the effects of each albino allelomorph are observed in conjunction with the effects upon coat color of each of the mutations: nonagouti, yellow and pink-eye:

	Nonagouti (aa)	*Yellow (A^y)*	*Pink-eye (dd)*
Full color (CC)	Black	Orange	Tawny
Intense chincillla (c^ic^i)	Black	Cream	Buff
Ruby-eyed dilute (c^rc^r)	Sepia	Ivory	Cream
Extreme dilute (c^dc^d)	Pale Brown	White	White
Albinism (cc)	White	White	White

From this table may be seen that ruby-eyed dilution and extreme dilution are practically complementary with yellow and pink-eye in the elimination of pigment from the hair of the mouse's coat. The Albino allelomorphs are potent reducers of yellow, while the agouti allelomorph, yellow, and the pink-eyed dilution eliminate the darker pigments, namely, black and brown. Thus the mouse of the composition $c^rc^rA^y$ or $c^dc^dA^y$ is a virtually black-eyed white type. The physiological explanation of this phenomenon should prove to be very interesting.

The occurrence of intense chinchilla produces a very close parallel between the albino allelomorphs of the house mouse and those of the rabbit. An almost complete homology exists between the several members, with the exception of the Himalayan albinism of the rabbit and the member next to albinism in the mouse, extreme dilution. Between

these two, there exist considerable differences of color intensity and distribution. An attempt to compare the series of the mouse with that of the guinea-pig becomes very difficult. As reported earlier in this paper, in the mouse the intensities of black in the fur, of black in the eyes and skin, and of yellow tend to remain parallel in the various compounds; whereas in the guinea-pig, as pointed out by Wright (1925), this is not the case. The Norway rat has only one member between intensity and albinism. This member, ruby-eyed dilute, resembles the ruby-eyed member of the mouse series in the black and yellow intensities of its hair, but it has far less pigment in skin and eyes.

SUMMARY

A fifth member of the albino series of allelomorphs, intense chinchilla, is reported for the house mouse, *Mus musculus*. It is the most intense of the series below full intensity in black and yellow pigmentation of the hair, skin and eyes. It is completely recessive to full color and is incompletely dominant over the other three members of the series.

This paper is a contribution from the laboratory of Vertebrate Genetics of the University of Michigan. A grant from the Faculty Research Fund, University of Michigan, aided this work also.

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LIGHT PELAGES IN PEROMYSCUS

By R. R. Huestis

[*Plate 6*]

Until the present year I have always had one or more specimens of *Peromyscus maniculatus* that grew, usually during the winter months, a partial or complete light pelage. This coat may be superseded in a few weeks by one that is normal in appearance or it may be retained as long as four months. This is not an uncommon phenomenon among Pacific coast deer mice, for Sumner has a number of unpublished records of "ashy" individuals. Dr. Sumner has called my attention to Morgan's description (1911) of a similar pelage condition in *Mus*. This paper is a record of the data I have gathered about some twenty individuals which grew a partial or complete light coat.

As may be observed in pl. 6, fig. 2, showing the replacement of a light pelage by a normal one, and in pl. 6, fig. 3, showing the replacement of a normal pelage by a light one, color change is occasioned by a molt as in *Lepus* (Grange, 1932). Sometimes the molt is complete as in the case of the animal shown on the left in pl. 6, fig. 1, and in the case of the one shown in pl. 6, fig. 2. More often an animal, after growing a partial coat of light hairs, ceases to molt for a while or continues the process by growing hairs which are more normal in appearance, and therefore less distinguishable from the old coat. I have not observed any case in which the growth of light hair was halted and then continued, after a period of some weeks, with similar light hair. I have no record of a second light coat in any individual.

This seems to mean, in *Peromyscus*, that the physiological condition that determines the growth of light hair is not long continued. Whether or not it is responsible for the discontinuity in the molting process cannot very well be determined, because a postponement of the completion of a molt is of rather frequent occurrence in captive deer mice. Indeed, while molting is most likely to occur in the fall, mice can be found with patches or tufts of incoming hair during any month of the year.

There is a variation in the color of the light pelages from gray to almost white. The light specimen shown on pl. 6, fig. 1, a *Peromyscus maniculatus gambelii*, is about average in shade. The mouse figured with him is a cagemate trapped at the same time. The latter is in the process of growing a normal winter coat which is considerably darker, it may be observed, than the worn pelage still present over the rump and hind quarters.

An examination of the hairs of three individuals killed before they lost their light pelages brings out the following facts. The lightest pelage color is produced by an absence of pigment in the distal portions of all classes of hairs. The proximal portions of such hairs generally contain some pigment where, as in the case of the winter pelage of certain species of *Lepus*, it cannot be

readily seen unless the hair is parted. The various shades of gray, which are the commonest light pelage colors in *Peromyscus*, are produced by a pigmentation of the hair tips. Proximal to this the hairs are white for a considerable part of the hair shaft. The tips may be very faintly pigmented on the hair cortex only or they may have pigment in both cortex and medulla distal to the part of the hair shaft which is devoid of pigment. In this particular and in general appearance light-pelaged individuals resemble "silver" *Peromyscus*, a coat color inherited as a recessive character (Huestis and Barto, 1934).

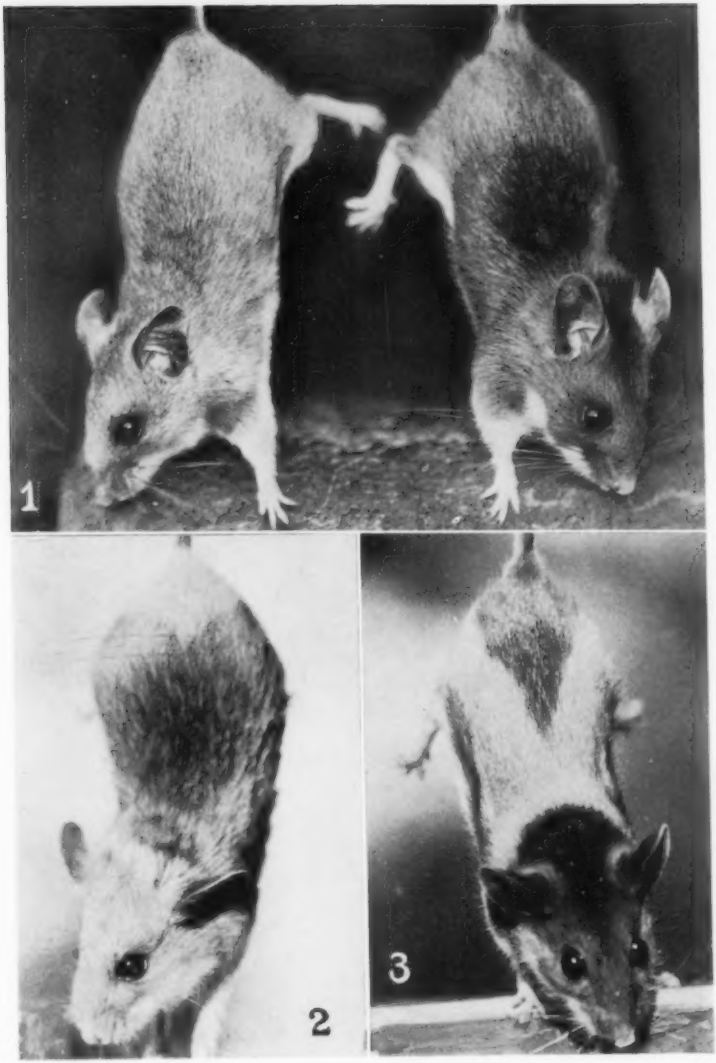
In addition to hairs with dark tips a light pelage may contain some normal-appearing hairs that may have been left over from the preceding coat. In support of this explanation are the facts that any new pelage may contain hairs with brown (faded?) tips, that a post-juvenal pelage often contains hairs that look like those of the juvenal coat, and that a normal pelage that succeeds a light one may contain a certain number of the "light" hairs.

There is possibly some significance in the fact that of eight trapped mice that assumed a light pelage all did so in the fall or winter months. But while this may suggest a tendency for light pelages to be donned in winter, it might be due to the fact that most of the trapping has been done in late summer and that the first molt made after an animal has been subjected to the conditions of captivity normally takes place in the fall or winter.

Somewhat indefinite results were obtained from attempts to test the genetics of the character. One mating of two animals, both of which had been pale, produced four young, three of which were quite pale and one slightly pale in post-juvenal pelage, while young from other matings born at the same time and subjected to the same feeding routine were normal in appearance. This promising family of mice was accidentally killed. Recently a much more comprehensive test was almost completely barren of results.

The mouse pictured in figure 3, a cage-bred *P. maniculatus gambelii-rubidus* hybrid, (F_3 ♂ 32) was mated with two half-sisters. The matings produced 10 young, one of which, a female, grew a partially pale post-juvenal coat. From the same male mated with this daughter and with two of her sibs, 17 young were obtained. None of these were pale in post-juvenal or first adult coats. I have a good deal of additional data on other relatives of F_3 ♂ 32 and on relatives of other cage-bred animals which grew a light pelage. These data, without being genetically critical, add to the probability that a familial tendency to grow a light pelage is not very pronounced in the environment in which I keep the stock.

It should perhaps be added, before conclusion, that the individual pelage color in a mouse is ordinarily a very stable character. Some time ago Dr. H. B. Yocom and I partly depilated mice that were receiving large doses of either thyroxin, posterior pituitary substance or suprarenal cortex. No color difference could be observed in the incoming hair.



LIGHT PELAGES IN PEROMYSCUS

FIG. 1. Light-pelaged *Peromyscus maniculatus gambelii* (left), trapped while in normal pelage in central Oregon, with normal cage-mate trapped at the same time.

FIG. 2. A light-pelaged *Peromyscus maniculatus gambelii* growing a replacing coat of dark hair.

FIG. 3. Late post-juvenal *Peromyscus maniculatus gambelii* hybrid with saddle of incoming light hair. The light pelage was not completed.

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SUMMARY

Both wild and cage-bred *Peromyscus* may, while in captivity, grow a partial or complete light pelage.

The light color is produced by a lack of pigment in the terminal or subterminal region of the hairs.

Attempts to fix the character by breeding light-pelaged individuals and their close relatives have not been successful.

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OBSERVATIONS ON THE BIG-TAILED SHREW (SOREX DISPAR BATCHELDER)

BY G. H. H. TATE

During the latter part of August, 1934, an attempt was made to secure specimens of the exceedingly rare *Sorex dispar* for the collections of the American Museum of Natural History, New York. The facts known concerning the discovery and distribution of this shrew have been recently fully reviewed by Jackson (1928) and by Harper (1929). *Sorex dispar* is known typically in highly boreal pockets in the Mt. Marcy region of the Adirondacks. Besides the original specimens collected by Batchelder (1896, 1911), Jackson (1928), in his revision of the long-tailed shrews, referred to *dispar* 8 specimens from the Catskills recorded by Mearns (1898), 3 from Mt. Graylock reported by Copeland (1912), 1 from Lake Leigh, Sullivan Co., Pennsylvania, and 1 from Winding Gulf (4 miles southwest of Pemberton), West Virginia. He omitted the record by Kirk (1916) of two specimens from Vermont, and seemingly he was unable to examine in time for comment the 3 males from Beede Brook discussed by Harper.

Before the ravine of the Beede Brook, where Harper collected *S. dispar* in 1926, was visited, a series of traps was set in and about the so-called ice-

cavern of Cobble Hill, a mile or so southwest of Elizabethtown. The ice-cave formation is here established by the fall of masses of rock from a scarp-face into a ravine, the ravine and cliff (1100 feet) probably representing a fault line. Furthermore, the rock-fall is far more limited in extent than that along Beede Brook, which was next visited. Only a very small quantity of ice was found at Cobble Hill under the piled-up rocks and the only *Sorex* trapped there was *S. fumeus*.

From Cobble Hill, camp was moved to the edge of Chapel Pond, which drains into Beede Brook,[1] where conditions were found to be altogether different from those obtaining when Harper worked there. The season was so exceptionally dry that water which no longer flowed in the brook bed occurred as pools only in the deeper holes. Furthermore, construction of a new highway to supersede the old winding road was in operation through the whole extent of the pass between the Schroon Lake—Elizabethtown road and St. Huberts. Finally, our visit took place one month later than Harper's. Throughout week-days the roar and rattle of trucks and steam shovels was incessant, and periodical blasting showered the habitat of *dispar* with fragments of rock.

It is unnecessary for me to repeat the description of the Beede Brook ravine, which has been so well done by Harper and Harper (1929). However, a couple of points of general interest are worth noting. Ice in small quantities was still to be found at the bottom of several of the deeper crevices between the rock-masses of the slide, and *Cornus canadensis* was seen in flower as late as August 31 (compare Harper and Harper, p. 41).

A line of 75 mouse traps was maintained along the rocks from August 28th to September 1st, during which time two specimens of *Sorex dispar* and a few red-backed mice were taken. When first set, the traps were baited with combination bait. Experiments were made with fish entrails and for the last two nights bacon only was used. The first shrew was trapped with combination bait, the second with bacon. These animals are now catalogued as A.M.N.H. 98210 and A.M.N.H. 98208.

Harper points out that no females of *S. dispar* have so far been taken from the type region. Both of the recently caught specimens were found upon dissection[2] to be females. The first caught (A.M.N.H. 98210) was fully adult and contained two embryos 12 mm. in length, one in each horn of the uterus. The second female, caught between 7:30 A.M. and 4:00 P.M., was rather smaller (and probably younger). It contained no embryos.

[1] The name Beede Brook, which on many maps is shown as passing through Chapel Pond, is said to be wrongly applied. Chapel Brook should be employed, true Beede Brook flowing from the side of Giant Mountain and uniting with Chapel Brook at St. Huberts. In the present paper I shall continue to use the Beede Brook of Harper.

[2] The sex of all the shrews collected was determined by examination of the reproductive system within the body cavity.

Harper has discussed the peculiar bare character of the tip of the tail of his male specimen and of Batchelder's specimen from Mount Marcy. In the first of our females this characteristic showed full development. Besides being very long, the tail appeared in the flesh but little thinner at the tip than at the base. The tip itself appeared thick-skinned and rounded, giving the impression that it might function as a tactile organ. However, that this bareness of the tip of the tail cannot be considered a character was promptly shown by the second female. The tail of that animal, though equally long and of uniform thickness, possessed a well-developed terminal pencil of rather stiff hairs, 5.5. mm. in length.

I was fortunate in meeting Mr. C. Goldmark of St. Huberts, who has roamed the Adirondacks for half a lifetime. He knew Mr. Batchelder well and had often had him at his house. He assisted me in locating the actual ravine which is the type locality of *Sorex dispar* and informed me that the name of the stream flowing in it (not printed on maps) is Beaver Brook. Harper describes it (quoting Batchelder himself) as "less than a mile to the westward [of Chapel Pond], in a ravine tributary to the valley of Beede Brook and joining it from the south." Only Beaver Brook fits this description. It rises on the southern slopes of Round Mountain and the mouth of the ravine faces on St. Huberts between Icy and Beede Brooks. Fifty traps were set in this ravine for two nights but no additional *S. dispar* was caught.

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NOTES CONCERNING MANATEES AND DUGONGS

By O. W. Barrett

The paleotropical dugongs and the neotropical manatees are probably much more common and widespread than is generally believed. Because of their peculiar habits, however, few travelers or hunters ever have personal contact with them. Less is actually known about them—perhaps, than of any of the larger mammals.

Except under certain conditions, they are exceedingly shy; and their nocturnal feeding habits protect them from human contacts, except in the case of their being hunted, as in Central America and northern South America and, rarely, in tropical Africa and Malaya, or when caught in fish traps. Their extreme wariness as regards non-aquatic dangers in the daytime does not extend, apparently, to their under-water enemies; they are afraid of a a leaf falling into the water, yet they pass their lives among sharks and crocodiles, and the reason for their terror of things above the surface can hardly be explained by hereditary instinct, for their safety has always been jeopardized by aquatic predatory enemies.

The food habits of all the living Sirenia are essentially the same—all feeding on sea plants or fresh-water grasses. In the writer's experience no herd ever changes its pasturage. What might be called an exception is the case of the Manati-Dorado herd of manatees on the north coast of Puerto Rico. In pre-Columbian times these animals were so plentiful in the bayous, swamps, and estuaries midway along that coast that the Spaniards gave the Arawak name of the animal to that locality; but with the silting-up of the waters behind the present town of Manati[1] and the coming of people with better weapons the herds were gradually driven out to sea, where they now graze on bottom-growing marine plants in the shallow water one to two miles off shore, instead of on the malojillo grass (*Panicum molle* or *P. jumentorum*) growing on the banks of the brackish and fresh waters back from the coast.

Trichechus manatus manatus Linnaeus

The animal is fairly common in most of the fresh-water bayous, lagōons, and rivers along the east coast of Nicaragua. No evidence of migration has been obtained, and salt water, apparently at least, is very objectionable to this species. One of the best known herds of manatees on the Caribbean coast is that inhabiting the Indio River and its bayous, just north of Greytown, Nicaragua. The estimates given for the number of animals in this region vary from a few score to several hundred. The herd apparently is stationary there, and apparently does not increase or decrease to any noticeable degree from year to year, although the natives take heavy toll, killing one or two halfton animals whenever they feel a hankering for fat meat instead of fish.

Hunting the Indio River manatee is usually done on moonlight nights. Two men in the smallest possible "cayuca" (dugout canoe) go to the likeliest "grazing ground"

[1]The Arawak name should be preserved; the accent is on the ultimate *i* or *ee*.

and conceal themselves near the river bank. Soon after twilight the herd arrives from its daytime place of concealment. Avoiding quick motions before the "strike," the harpoon-man makes sure that his weapon, with a thrust of about six feet, puts the barb through the two-inch hide in the neck or shoulder region, then promptly pays out a dozen yards or so of rope. Since there is seldom a chance for the gunner to shoot at the time the harpooner strikes (for the gunman must work the cayuca up to the game by signals from his partner in the bow), he must wait till the frantic rushes of the animal compel it to come up for air; then, even, he may waste one or two expensive shots on the nose before the brain is hit or the nasal passages blocked. A heavy charge of large shot (or nails or pebbles) in the head at very close quarters may put an end to the tremendous rushes, which a dozen canoes could hardly check, within a few anxious minutes. About two out of every three harpooned animals may be shot and nearly all of those shot are recovered; but many things can happen between strike and shot, and a Nicaraguan would rather go meat-hungry a week than be spilled, in darkness, into a crocodile-infested lagoon. Although serious accidents may happen during the killing of a manatee, the animal, it is said, never willfully attacks the cayuca, or (when capsized) its occupants, or in any way tries to defend itself when attacked. Attempts to escape by rapid swimming, diving, and quick turning are its only tactics.

A manatee can remain under water for 10 to 30 minutes when frightened. The natives believe that the animal does not repose with the head supported out of water, though this is a matter to be proved. When the animals are frightened—as during the daytime, in the "lair"—the slightest unusual noise, like rain falling on a tin pail in a cayuca, or the spitting of the hunter, is sufficient to keep the whole herd submerged from sight for hours; yet while they are grazing the hunter may go up and slap them on the back unnoticed. Families consisting of a bull, a cow, and one or two immature calves, are usually met with; these groups merge into a loose herd of from 10 to 50 or more individuals living in a lagoon or certain stretch of river, concentrating during the day and cattering at night.

The Central American animal feeds entirely, according to the writer's observation, on Para grass (*Panicum molle*). This plant is one of several grasses that grow on the banks of the fresh-water lagoons and rivers, the roots always remaining in the soil above the mean level of the water and the stems floating out some 6 to 10 feet from the bank. Only the tender vertical tips of the stems are eaten, the portions remaining in the water or forming a mat just above it being never touched.

They generally graze at night, though occasionally a few individuals may be seen feeding in broad daylight. The body is held nearly vertical while grazing. The head is held well out of water, as the arm-like flippers poke the grass toward the mouth. Little chewing is done. Probably the peculiar gland emptying into the stomach assists in digesting the coarse, unmasticated roughage. The noise made by the flapping of the huge upper lip and the crunching by the large teeth can be heard distinctly on a still night 200 yards or more away. The sound made by a dozen or more manatees grazing on the "yerba Guinea" is much like that of horses grazing in pasture.

Short, stubby bristles are sparse-set in the thick lip-flaps of the upper jaw; the deep cleft between these great flaps allows of their sidewise motion when feeding. The flaps scoop the grass (or seaweed) into the rather small mouth cavity. The mouth odor, by the way, of both the dugong and the manatee is almost precisely like that of the cow, though the former animal may never have tasted true grass.

Mating is said to take place in shallow water, the male and female rolling over each other and making considerable splashing. Only one calf is born at a time; this remains with the cow till half grown—probably even after the birth of the next one.

Adult Nicaraguan manatees appear to average somewhere between 8 and 10 feet in

length; some, old females presumably, may reach 12 feet. The estimated weight of a mature male, 9 feet, 2 inches long, dissected by the writer, was close to ten hundredweight. The flavor and texture of the flesh is excellent; in my opinion it is in the same class as "veal hippo," than which there is no better meat. In point of fact there are three kinds of flesh in the manatee and the dugong; the thick breast, back and tail muscles, which are light colored, like veal; the red pelvis-region steak; and the fat spare-rib slabs. The blubber blanket is—properly, for an inhabitant of tropical waters—only about 1 to 1½ inches thick along the sides. "Manteca," a lard-like, oily cooking fat, tried out from the insulating blubber blanket, is prized locally. Bacon, salted and smoked from the belly regions, is excellent; the thick chunks of flesh (four wheelbarrow loads, in our specimen) corn well, and may be jerked or smoke-dried. When roasted, fried, or stewed, the flesh remains tender and holds its gamey taste, with none of the tough dryness of turtle nor the oily fishiness of porpoise meat.

The thick, exceedingly tough hide is not common in trade; a tannery in Santurce, Puerto Rico, years ago, cured a few hides and the leather was used for valve packing where an extra strong article was required. The skin color is grayish, with an olive cast in freshly-killed animals; its thickness presumably is useful in defense against sharks and "caimanes."

The braincase appears comparatively small for such a large animal. The cylindrical stapes of the inner ear are saved by the Nicaraguans as charms against ill-luck. Near one end of the stapes there is a natural perforation, which facilitates stringing it; unless these bones are kept in the mouth an hour or so it is believed that the hole will close up and thus "spoil the charm's power."

Anatomy.—This account is based mainly on the examination of an adult male, 9 feet, 2 inches in length, captured near the mouth of the Rio Indio, 10 miles north of Greytown, Nicaragua, during January, 1917. The body color is a dull gray, varying from a dirty whitish gray to an uneven, almost mottled, bluish-brown gray. The skin varies from about one-third to two-thirds of an inch in thickness; it is used, smoked or dried, for thongs, whip-lashes, and even fancy canes. The hairs are very sparse, colorless, and fine with the exception of those on the lips—about one every 4 inches; they can be extracted easily with the thumb and finger.

The lungs are very long, almost cylindrical, extending from the throat to near the posterior portion of the body cavity. To make room for them an extension of the diaphragm runs back behind the kidneys. The "blow," however, is usually a rather silent one, and not misty.

The stomach is nearly oval, with a conical flap-like pouch (empty, though the stomach may be very full) near the pyloric end, and with a peculiar large gland-like body attached by means of a short duct to the cardiac side. This gland-like body is covered with the same muscular wall as the stomach. It appears to be the source of the secretion that is poured into the left side of the stomach through a thick neck or duct some 1½ inches long; no trace of food was found in this glandular organ, but it had a distinct lumen surrounded by peculiarly colored laminae and complex folds. The intestinal canal appeared to be about 50 feet in length and of even diameter from pylorus to rectum; no appendix was found.

The pelvic muscle mass was reddish in color. It consisted mainly of muscle and some cartilaginous tissue. No pelvic bones were found. The base of the penis was the only visible structure in this region. No other portion of the body has red tissues.

The testes are greatly flattened, about six inches long, four inches wide, and two inches thick in a nine foot male; the exterior, as well as the epididymis, was of a bluish or purplish gray. The epididymis is comparatively large, its tubules loosely coiled. If any vesiculae seminales were present they were empty and inconspicuous.

The penis extends from the pelvic muscle mass along the floor of the abdomen to the sheath-pouch, a distance of some 2 feet; the sheath-pouch is only some 4 inches long and is nearly filled by the glans, or the terminal portion of that organ. Had it not been for the presence of the conical beak-like cartilaginous point, precisely in the median line, and near the dorsal margin of the glans, the writer would have felt certain that the organ had been bitten off about four inches from the body. The length from sheath opening to tip of the firm cartilage "beak" is about four inches, the diameter about three inches. The only free portion of the penis is that which is held in the sheath; not more than 4 or 5 inches of its length could possibly be protruded. A cartilaginous rod-like structure extends along the dorsal side from near the base to the beak-like tip of the glans; this structure cannot stretch. The glans is excavated deeply; the conical cavity extends backward some 2 inches, and conceals the meatus on its ventral aspect. Both outside and inside of this cavity the glans is covered with a rugose multicolored integument; the pigment spots (of black, blue, gray, reddish, and whitish) are small and scattered without any pattern. The apex of the glans is barely covered with a tough skin drawn over the cartilaginous process, which is rounded off at the tip and about one-half inch in diameter. Judging from the numerous rugae, which are scarcely apparent at 2 yards distance, the diameter of the glans in erection would probably be about 5 inches as against 3 in repose. The penis, however, cannot, apparently, on account of the large amount of aponeurotic tissue in its dorsum and sides, alter its size, shape, or position to any considerable extent. Copulation must, therefore, depend upon the glans alone. A very short urethral process arises, near the ventral margin, from the lower edge of a shallow depression below the "beak." There is no trace of a corona glandis. Except for the absence of the corona, the distal portion of the manatee penis, front or profile view, greatly resembles that of an equine, as might be expected if the Sirenia are remotely descendent from or related to the solipeds. The exterior is dark-colored, roughish, and wrinkled longitudinally, but (unlike that of the dugong) with no trace of any telescoping sleeve; even with the penis completely retracted the longitudinal sheath opening does not quite close.

Dugong dugon (Müller)

The first dugongs seen by me were caught in fish-traps in Delagoa Bay in southern Portuguese East Africa, and, since the fishermen asserted that none ever had been seen in any of the bayous of either the Maputo or the Umbeluzi River entering the bay, from Zululand (and Maputoland) and from south central Mozambique respectively, it follows that the animals had probably wandered southward from the Zambesia coast. I never heard of any dugongs that had been seen in either the Limpopo (absent because of the crocodiles?) or the Zambesi (or its tributary from Lake Nyassa, the Shiré, 370 miles long), yet there were, in 1909, at least two individuals in a rather large, shallow lagoon south of Inhambane—north of the Limpopo—apparently ignored by the M'chopes Kafirs. The dugong, however, seems to prefer the sea, several adults and one "calf" having been taken in fish kraals in Delagoa Bay during the writer's stay [1908–10] in Mozambique.

The following incident indicates the rarity of dugongs on the southeast coast of Africa. In 1908 some Shangaan Kafir fishermen finally succeeded in killing a "white porpoise" which had entered one of their offshore stake fish-traps near the mouth of the great Delagoa Bay; seeing that it was some new sort of "devil-fish" they gave it to an Italian blacksmith, who may have heard of such an animal in the Red Sea near Eritrea; he (with some assistance from the writer) dressed it—a probably mature male nearly seven feet in length—refrigerated it, made a rude coffin, freighted it up to Johannesburg, rented a show-room, and made his fortune exhibiting "the only genuine merman—half fish, half human."

The excessive abundance of crocodiles in the East African rivers, rather than the absence of forage, probably accounts for the scarcity of dugongs there. What sort of marine plants are eaten seems a mystery; the Persian and Arabian Gulfs and the Red Sea appear comparatively free of large seaweed masses; recently, however, the writer noticed peculiar "slabs" of, presumably, some dark reddish growth, about 3 to 5 feet long by 1 or 2 feet wide, floating just below the surface of the Red Sea.

Perhaps the most obvious anatomical difference between the manatee and dugong lies in the structure of the penis. In the dugong this organ is moderately long, rather slender, and possessed of a distinct glans which has both a prominent processus urethrae protruding from a peculiar fossa and a corona. The body of the organ can be extended some 10 to 15 inches (in an 8-foot specimen) beyond the sheath opening, which is flush with the ventral surface.

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North Clarendon, Vermont.

A NEW SPECIES OF PORCUPINE FROM THE LATER CENOZOIC OF IDAHO

BY ROBERT W. WILSON

One result of continued exploration for fossil vertebrates in the late Cenozoic sediments of the Snake River Valley by the United States National Museum was the discovery, during the summer of 1934, of a ramus of a fossil porcupine in deposits exposed near Grand View, Idaho.[1] This specimen has been kindly loaned to me for study and description by Dr. C. Lewis Gazin. Interest attaches to the specimen since it represents not only the oldest *Erethizon* to be recorded from the North American region, but also the first remains of porcupines to be found in this area in beds other than cave or fissure accumulations.

Erethizon bathygnathum, new species

Locality—Castle Butte, 13 miles northwest of Grand View, Owyhee County, Idaho.
Type—Fragmentary left ramus with P_4-M_2, no. 13684, U. S. National Museum.
Horizon—Idaho Formation (?); upper Pliocene or lower Pleistocene.
Specific Characters—Ramus deeper and more massive than in Recent species of *Erethi-*

[1] For the principal fossil localities where rodent material has been obtained, see Wilson, R. W., Carnegie Inst. Washington, Publ. 440, p. 120, fig. 1, 1933. For a description of fossil lagomorph material obtained in the Snake River basin, see Gazin, C. L., Proc. U. S. Nat. Mus., vol. 83, no. 2976, pp. 111–121, figs. 1–5, 1934.

zon. M_1 and M_2 in comparison with P_4 relatively larger than in the Recent North American porcupines. Size slightly larger than *Erethizon epixanthum nigrescens*.

Description—The ramus of *Erethizon bathygnathum* is deep and massive. This is especially noticeable in the anterior portion, in the region of the symphysis. The anterior border of the coronoid meets the horizontal ramus opposite the posterior roots of M_2. The shelf-like excavation for attachment of the masseter medialis is not preserved in *E. bathygnathum*. However, enough of the fossil jaw is present to suggest a somewhat more posterior termination of the masseter medialis ridge or its lesser development. Individual variation in the formation of this ridge among recent specimens indicates the possibility that with a complete ramus at hand no peculiarities of this part of the fossil jaw might be noted. The masseter lateralis ridge presents a less angulate appearance than in recent *Erethizon* of the same age, and rounds into the inferior surface of the ramus. Attrition resulting from transportation before burial may have modified the original shape of the masseter lateralis ridge in the type specimen.

The considerably worn dentition shows a typical *Erethizon* pattern. P_4 is somewhat shorter and broader than in most recent specimens of *Erethizon*. The anterior lake is

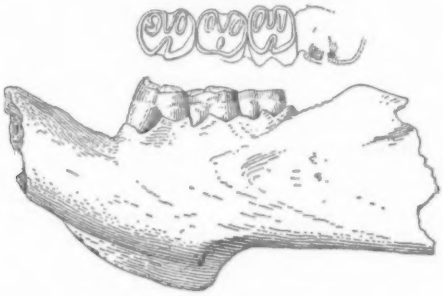

FIG. 1. *Erethizon bathygnathum*, n.sp. Type specimen, left ramus with P_4-M_2, no. 13684, U. S. Nat. Mus., lateral and occlusal views; natural size. Grand View, Idaho. J. L. Ridgway, *del*. It is to be noted that in the figure the jaw has been tilted sufficiently to bring the symphysial border into view.

complicated by a small re-entrant fold. M_1 is slightly longer than broad. This tooth is much worn and the external re-entrant fold is isolated. M_2 differs from M_1 in having the transverse diameter greater than the antero-posterior diameter, and in being slightly less worn. M_1 and M_2 are noticeably larger in respect to P_4 than in recent individuals of *Erethizon dorsatum dorsatum* and *E. epixanthum nigrescens*. The size of the animal represented by no. 13684 would appear to be slightly larger than that of individuals of recent species, if comparisons with rami of *E. e. nigrescens* and *E. d. dorsatum* are dependable.

Remarks—The occurrence of porcupines in the fossil record of the North American region is rare. Both recent species of *Erethizon*, namely *E. dorsatum* and *E. epixanthum*, have been recorded from middle or late Pleistocene cave or fissure deposits. The only extinct species so far described is *E. godfreyi* (Allen, 1904), from a volcanic fissure in Arizona, and probably of late Pleistocene age. This species is represented by a single specimen consisting of a rather complete skull. Although direct comparisons with *E. bathygnathum* can not be made, *E. godfreyi* apparently represents a somewhat smaller species.

Hystricops venustus (Leidy, 1869, p. 343), reported from the Pliocene of the Niobrara

River (Snake Creek) has been assigned at different times to the porcupines and to the beavers. The original material consisted of two isolated upper molars, and no additional remains have since been obtained. At the present time it is apparently impossible to place this genus systematically. From what is known of our Tertiary rodent faunas it seems likely that *Hystricops* is a member of the Castoridae. However, the finding of the Snake River material pushes back the known history of the Erethizontidae to upper Pliocene or lower Pleistocene and suggests perhaps that hystricomorphs were present in the North American area in earlier Pliocene times. Presence of edentate remains in the upper Snake Creek indicates that South American types were penetrating the northern region at this time.

No direct comparisons between *Erethizon bathygnathum* and *Hystricops* can be made. The type molar of *Hystricops*, however, seems much too large to fit into an upper dentition like that which *Erethizon bathygnathum* probably had. The presence in *E. bathygnathum* of a lower dentition very similar to that of the recent *Erethizon* makes an association of these mandibular teeth with upper molars like those illustrated by Leidy for *Hystricops* seem highly improbable.

Comparative measurements (in millimeters)

	E. bathygnathum U. S. N. M. Grand View no. 13684	*E. d. dorsatum* Dickey Coll. Recent no. 11504	*E. e. nigrescens* Dickey Coll. Recent no. 6764
Alveolar length of toothrow, P_4-M_3	33.6 (a)	31.1	30.4
Crown length of toothrow, P_4-M_3	22.5	21.4	20.8
P_4, antero-post. diam. of crown	8.5	8.5	9.5
P_4, transverse diam. of crown	7.7	6.9	7.6
M_1, antero-post. diam. of crown	7.2	6.7	6.0
M_1, transverse diam. of crown	7.1	6.5	6.1
M_2, antero-post. diam. of crown	6.8	6.7	5.9
M_2, transverse diam. of crown	7.3	6.4	7.0
Depth of jaw below M_3	19.5	17.9	16.8
Depth of jaw below ant. end of P_4	24.3	19.8	19.2

(a) Approximate.

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GENERAL NOTES

VITALITY OF THE VIRGINIA OPOSSUM AS EXHIBITED IN THE SKELETON

Considerable attention and speculation have been given to the subject of the Virginia opossum, *Didelphis virginiana virginiana*, and its ability to compete so successfully with placental mammals. The ability of this animal to recover from injuries was forcefully called to my attention recently while examining skeletons of the species.

In connection with my duties at the Museum of Birds and Mammals, University of Kansas, I had occasion to examine 95 skeletons of *Didelphis v. virginiana* from the vicinity of Lawrence, Kansas. Of these skeletons, 39 gave evidence of broken bones that had completely healed. They varied in seriousness from a broken phalanx in one instance to several of a very serious nature, broken ribs, usually 3 or more, being the most common. One of the most serious cases was one specimen that had suffered, and recovered from, the following breaks: both scapulae, eleven ribs, two of which were broken in three places and two more in two places, and a rather extensive diseased condition of the vertebral column, probably the result of injury. Another had suffered almost the same injuries and still another gave evidence of having suffered at the same time fractures of the lower left jaw, the right scapula, and nine ribs. Next to ribs, which were broken in 21 different animals, scapulae appeared to be the most vulnerable. Such breaks occurred in 12 different individuals, often both scapulae being so injured.—J. D. Black, *Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas.*

SOREX DISPAR IN NEW HAMPSHIRE

Recently there appeared in this journal (vol. 14, p. 70) a note by Deane W. Mather concerning the taking of a specimen of *Sorex dispar* on Mount Washington, New Hampshire. It was secured on August 21, 1932, in the vicinity of Upper Hermit Lake in Tuckerman's Ravine and was considered perhaps the first record for the state.

On June 13, 1932, I took a specimen (no. 28737, Mus. Comp. Zoöl.) of this shrew from a point higher up in the same ravine. The altitude was about 4850 feet and the locality a seemingly unpropitious boulder-stream just below the Alpine Garden. Identification was made by Dr. Glover M. Allen of the Museum of Comparative Zoölogy, Cambridge, Mass.

Late in July, 1932, two more specimens were taken in the same locality.—Alexander Lincoln, Jr., *Chocorua, New Hampshire.*

AN ALBINO SHREW

In his review of the North American species of *Sorex* and *Microsorex*, Dr. H. H. T. Jackson calls attention to the relative rarity of albinism, and mentions but one specimen, a skin without skull, no. 241190, U. S. Nat. Mus., from Alaska, apparently *Sorex tundrensis*, as the only complete albino in the series of over ten thousand specimens he studied. It is therefore worth while to make brief record of a completely albino specimen generously presented to the Museum of Comparative Zoölogy by Professor William Rowan of the University of Alberta. It was retrieved in July, 1934, from a well at Seba Beach, Alberta, where it had evidently fallen in and drowned. The entire pelage as well as the skin is pure white, and even the eyes show no pigment in the specimen as preserved in alcohol. The skull, which has been removed for examination, shows that this is one of the *Sorex cinereus* group, but although it comes from the general area indicated by Dr. Jackson as inhabited by the typical race, it is slightly larger than eastern specimens, approaching in the size of the skull the race *streatori* of the Northwest Coast, between which and typical *cinereus* it may be regarded as an intermediate. I am indebted to Professor Rowan for the opportunity of recording the specimen which is

now no. 33817, M. C. Z. While complete albinism may apparently be looked for in occasional individuals of any animal, it is apparently rarer in some than in others; and among the Insectivora it is commoner in moles than in shrews, possibly because the more restricted habitat of the former is more favorable for inbreeding and the consequent occasional reappearance of this abnormality if it once crops out in a community.—GLOVER M. ALLEN, *Museum of Comparative Zoölogy, Cambridge, Mass.*

FOOD HABITS OF THE SEMINOLE BAT

It is generally agreed that the food of bats inhabiting the United States and Canada consists almost entirely of flying insects. However, a few of these bats are known to obtain some of their food from the ground.

An *Antrozous pallidus* was seen to descend suddenly to the ground and was captured unhurt shortly afterwards. It was then found to have a Jerusalem cricket between its jaws (Nelson, 1918, Nat. Geogr. Mag., vol. 33, no. 5, p. 493). This cricket, *Stenopelmatus fuscus*, a flightless species, is also eaten by *Antrozous pacificus* as shown by the finding of the remains of these insects under the roosting places of these bats by H. W. Grinnell (Univ. Calif. Publ. in Zool., vol. 17, no. 12, p. 355, 1918), and Hatt (Journ. Mammalogy, vol. 4, no. 4, p. 260, 1923). Also in the material examined by Hatt remains of scorpions, *Anuroctonus phaiodactyles*, were identified. That *Macrotus californicus* may seek some of its food on the ground is evidenced by the capture of a specimen of this bat in a mouse trap set on the open ground (Grinnell, 1918, p. 257).

The following observation shows that the Seminole bat, *Lasiurus seminola* (Rhoads), also includes flightless insects in its bill of fare.

The evidence for this last statement is that a Seminole bat, shot at 5:50 p.m., December 6, 1934, near Gainesville, Florida, had its teeth clamped onto the head of a struggling cricket. There is no doubt that the bat had caught the cricket before it was shot for apparently the bat died instantaneously.

The cricket was identified by Dr. T. H. Hubbell as *Gryllus assimilis* (Fabr.) variant *pennsylvanicus* Burmeister. Flight is impossible in the local variety because of the vestigial character of the membranous wings. While it is possible for it to jump and to crawl, Dr. Hubbell, who has had extensive field experience in studying the Orthoptera of this region, assures me that he has rarely found this form of *Gryllus* elsewhere than on the ground. For these reasons it appears that this Seminole bat flew exceedingly low or actually descended to the ground to capture the cricket.

When the bat was shot it was flying about 20 feet above the ground towards a large oak tree which it had nearly reached before it was brought down. The large size of the cricket, in proportion to that of the bat, suggests that the bat intended to alight to devour its catch.—H. B. SHERMAN, *Department of Biology, University of Florida.*

THE ARIZONA SPECIMEN OF EUDERMA MACULATUM

So far as the author knows, there are only six specimens of the spotted bat on record; and if one were to attempt to locate these specimens the whereabouts of only five could be determined from the literature. The sixth, taken in Arizona, is referred to indefinitely in the published records, and no certain indication of its location is given. Since the author has recently had the pleasure and privilege of seeing and photographing this specimen, it seems desirable to place all that is known about it in the permanent record.

Last spring (1934) a student in the author's class in mammalogy, Allan R. Phillips, an enthusiastic ornithologist, secured from Mrs. Herbert Brown, of Tucson, the privilege of going over the notebooks of her late husband, Herbert Brown, well known as a local bird collector in the eighteen-nineties and the early years of the present century. In one of these notebooks Phillips found the following notes on *Euderma maculatum*, which he brought to my attention:

"April 28, 1904. Today a couple of boys brought me a bat. Although I had never before seen one, I instantly recognized it as *Histiotus maculatus*. Under date of May 22, 1899, Dr. C. H. Merriam wrote me that a specimen of the bat in question had been taken in San Fernando Valley, California; that it was among the rarest mammals of the world, and to be on the lookout for it.

The specimen now in my possession was found in the valley about 4 miles south of here (Yuma, Arizona). It was clinging to the side of a brush house and when the boys first saw it they thought it was a young rabbit because of the size of the ears. At first they did not disturb it, but when ready to come home they held an old lard bucket under it and as soon as touched they say it just dropped off into the bucket."

"April 30, 1904. This morning I found the above named bat dead. Had been fed with flies and fresh meat, but it did not eat. The following measurements were carefully taken:

Extent (point to point of wing), 346 mm.; total length, 110; tail, 47; ear (from crown), 45; width of ear (natural shape), 25; ear (bottom of inside to tip), 43; length of tragus, 14; width of tragus, 6."

In 1905 Brown wrote: "Have shown the bat to many Indians (Yumas and Cocopahs) in the hope of being able to secure additional specimens. Very few claimed to have seen it. They said it lived in the woods and flew only at night. The only other specimen I heard of was one seen in a mine near Magdalena, Sonora, Mexico. There were many bats in the drifts and among them was the one spotted one. The party who gave me this information (R. McPherson) said that the Mexicans called it a 'pinto bat,' from which it would appear that such bat was there to call forth such name."

A chronological summation of all specimens of the spotted bat known to date follows, with first bibliographic reference to each:

No. 1, 1890. Type specimen no. $\frac{8\,8\,2\,0}{2\,0\,0\,1}$ American Museum of Natural History. From mouth of Castaic Creek, Santa Clara Valley, Los Angeles County, California; March, 1890; found hanging on a fence. Skull now lost. Original description—*Histiotus maculatus* Allen, Bull. Amer. Mus. Nat. Hist., vol. 3, pp. 195–198, Feb. 20, 1891. (See also, North Amer. Fauna no. 13, p. 49, 1897).

No. 2, 1903. No. 122545, United States National Museum (alcoholic specimen). From Mesilla Park, New Mexico, September, 1903; found dead in the Biological Laboratory of the New Mexico College of Agriculture. (Miller, Proc. Biol. Soc. Washington, vol. 16, p. 165, 1903. Skull figured.)

No. 3, 1904. In the possession of Mrs. Herbert Brown, 434 East Second Street, Tucson, Arizona. From Yuma, Arizona; April 28, 1904. Skull incomplete, lower jaw missing. (Stephens, California Mammals, p. 264, 1906.)

No. 4, 1907. No. 1196, Museum of Vertebrate Zoology. From Mecca, Riverside County, California; October 1, 1907. Skull incomplete and within the skin. Found "lying in a puddle, the overflow from the big railway water tank. . ." (Grinnell, Univ. California Publ. Zool., vol. 5, p. 317, 1910; half-tone cut, x 2/3.)

No. 5, 1922. No. 65171, Museum of Vertebrate Zoology. Captured in the zoological laboratory of the University of Nevada, Reno, Nevada, about September 10, 1922. Skin and skull complete. (Hall, Journ. Mammalogy, vol. 16, p. 148, May, 1935.)

No. 6, 1931. No. 262, Yosemite Museum (skin and skeleton). From Yosemite Valley, California, August 17, 1931. Found hanging on the side of a building, under the eaves. (Ashcraft, Journ. Mammalogy, vol. 13, p. 162, May, 1932.)

It may be noted that even now there are only four complete skulls of this species in collections. Thirteen years elapsed between the capture of the type specimen and the taking of the second individual. The third was taken less than a year later; the fourth record was made after three more years. After this, 24 years passed before the fifth record was made (no. 6, chronologically). During this long interval, however (15 years after the fourth capture), the Nevada specimen was taken; but it was not made known to science until the present year (no. 5). This seems to be truly a rare species, but, since two of these six specimens wandered into biological laboratories to be taken, perhaps others of us in the Southwest might hopefully try leaving our windows open.

The distribution record shows: California, 3; Nevada, Arizona, and New Mexico, 1 each. These specimens are extant. Brown's notes give credible evidence of the occurrence of the species in Sonora, Mexico.—CHARLES T. VORHIES, *University of Arizona, Tucson, Arizona.*

OCCURRENCE OF THE SPOTTED BAT IN UTAH

A female specimen of the spotted bat, *Euderma maculatum* (J. A. Allen), was taken at 48th South Street and Redwood Road in Salt Lake City on October 29, 1934. It was collected by Dan Holder at 8:30 o'clock in the morning under the eaves of the Plymouth School House. He turned the specimen over to Miss Dorothy Naylor of the Granite High School, who kept it under observation from that date until it died.

Miss Naylor put the specimen in a screen cage and kept it at room temperature. When first put in the cage the bat suspended itself from the screen near the top, and remained so for several days. It always followed this procedure when quiescent. At first it would take no food, so she fed it flies by force, with the aid of tweezers. Following a few forced feedings it took flies readily. When flies were placed in the cage with tweezers it would wrinkle up its nose and make the typical chipping sound of bats, and advance as rapidly as possible to seize its prey. The feedings were regulated to 8:30 o'clock A.M. and 4:00 o'clock P.M. As feeding time approached the bat would come down the screen and would follow the empty tweezers along the wire just as readily as if they contained a fly. In both cases it uttered the same characteristic sounds. The bat received five flies at a feeding. It was apparent that it took much water daily, as the container was empty every morning. The night of November 19 was very cold and the window of the room was left open. The next morning the bat was dead.

Miss Naylor gave the specimen to the Department of Zoölogy of the University of Utah. The skin and skull are now in the museum of this department, no. 1135. The species has been previously recorded from six localities. They are as follows: Mesilla Park, New Mexico; Yuma, Arizona; Piru, Mecca, and Yosemite Valley, California; and Reno, Nevada. The Utah specimen is hence the seventh known. It is of interest that this record extends the known geographic range of the species and sets the known northern and eastern limits.—STEPHEN D. DURRANT, *Department of Zoölogy, University of Utah, Salt Lake City, Utah.*

BATS FROM THE PANAMA REGION

Since the publication of E. A. Goldman's account of the mammals of Panama (Smithson. Misc. Coll., vol. 69, no. 5, pp. 309, figs. 24, pls. 39, 1920) the Museum of Comparative Zoölogy has received a number of bats from the Republic of Panama and the Canal Zone. Some of these are of sufficient interest to be worth recording. Most of the specimens were collected through the interest of Dr. Herbert C. Clark and Dr. Thomas Barbour. In some cases there are large series of individuals.

Rhynchiscus naso priscus G. M. Allen.—A series of ten from Summit, Canal Zone, includes one male and nine females. An accompanying note states that they were found

in a barn, an unusual resting place, though Carriker has reported taking a small group under the tiles of a roof in South America.

Saccopteryx bilineata bilineata (Temminck).—The following localities are represented: Culebra and Summit, Canal Zone; La Chorrera, Topagra, Tapia, Camoganti (Darien).

Saccopteryx leptura (Schreber).—One from Ft. Randolph, Canal Zone, constitutes a second record for this area.

Peropteryx macrotis macrotis (Wagner).—A large series, apparently from a single colony, was taken by Dr. Clark at Yasisa, and includes both sexes. The specific name *canina* in current use for this species, is unavailable, since *Vespertilio caninus* Wied, 1821, is preoccupied by *Vespertilio caninus* Blumenbach, 1797 (Handbuch d. Naturgesch., ed. 5, p. 73), a synonym of *Pteropus vampyrus*. The next available name seems to be *Emballonura macrotis* Wagner (Archiv. f. Naturgesch., vol. 9, sect. 1, p. 367, 1843), type locality Matto Grosso, Brazil. Peters, who in 1868 (Monatsber. K. Preuss. Akad. Wiss., Berlin, 1868, p. 472) examined the type in Vienna, says that it is identical with Wied's species.

Dirias albiventer minor (Osgood).—Goldman records only two specimens, both taken at Empire. Dr. Barbour secured several near Panama City some years ago, and Dr. Clark's collection contains over 150, mostly, perhaps, from a single colony at Las Cascadas, Canal Zone. Others are from a house at Summit, Canal Zone. The red phase seems comparatively rare in Panama, for out of a total of 160 individuals, six (three males and three females) are rufous, the rest dull olive brown. Dr. L. H. Dunn has already reported on the colony at Summit (Journ. Mamm., vol. 15, pp. 89–99, 1934).

Noctilio leporinus (Linnaeus).—This large bat seems to have escaped definite record for Panama. Dr. Barbour, however, procured two at Panama City and one at Ancon, Canal Zone.

Chilonycteris personata Wagner.—Six males from Penonome, Panama, appear to constitute the first record of the species from that region.

Pteronotus davyi suapurensis J. A. Allen.—The genus *Pteronotus*, though reported from both north and south of Panama, has not previously been recorded from the area in question. Dr. Clark secured 160 at Penonome, Panama, and one from the well-known Chilibrillo Caves. Of these, 26 represent the fulvous phase, the others the dull, grayish condition. Colin C. Sanborn calls my attention to the fact that these are probably best referred to *suapurensis* J. A. Allen, a large race extending from Venezuela to Costa Rica. Nevertheless, a specimen from Trinidad, representing typical *davyi*, is nearly as large, although another of the same lot is much smaller. The forearm of the Panama specimens averages 51.2 mm.

Trachops cirrhosus (Spix).—Two from Tapia.

Lonchophylla robusta Miller.—A series of seventeen was secured in the Chilibrillo Caves, Panama, the type locality. Of these, all but five are males. Of the smaller species, *L. concava*, none was found.

Carollia castanea H. Allen.—This small species continues to be rare in collections, in contrast to the larger *C. perspicillata azteca*, which is perhaps the most abundant cave bat of the region. Goldman secured several at Cana, the first record for Panama. There is a single male in Dr. Clark's collection, taken at Chilibrillo Caves.

Desmodus rotundus murinus Wagner.—For use in his experiments elsewhere published, Dr. Clark has been successful in obtaining many vampires from caves in the general region—Chilibrillo Caves, Brazos Brook tunnel, El Real (Darien), and on Taboga Island. These have been of the gray phase, but more recently he writes of securing a number in the browner phase, from hollow trees chopped down in the forest-swamps of La Jagua, 33 miles east of Panama City.

Natalus mexicanus Miller.—To Goldman's record of a single specimen from Coiba Island, I can now add the five specimens taken by Dr. Clark at Penonome, Panama.

Eptesicus propinquus (Peters).—A second locality record for the Panama area is afforded by a specimen from Tapia.

Lasiurus borealis mexicana (Saussure).—One from 'Panama.'

Rhogeessa tumida H. Allen.—Several from Balboa, Canal Zone.

Eumops abrasus milleri J. A. Allen.—Six from Tapia, Panama.

Molossus rufus sinaloae J. A. Allen.—Although recorded only from Punta de Peña by Goldman, this is probably a well-distributed species in the Panama area. Dr. Clark's collection contains specimens from El Real and Gatun. The females appear to be slightly smaller than the males. While 15 females have an average forearm measurement of 46.8 mm. (extremes 45.9–48.5), four males average 48.7 mm. (extremes 48.3–49.3). —Glover M. Allen, *Museum of Comparative Zoölogy, Cambridge, Mass.*

NOTES ON BAT NETTING

Bats are so difficult to secure in good condition that the article by Josselyn Van Tyne in the Journal of Mammalogy (vol. 14, no. 2, pp. 145–146) seemed to offer a happy solution of the problem. The net, while not used by the writer as extensively as had been hoped, provided some notes that may be of interest to others contemplating the use of nets for this purpose. Dr. Van Tyne very kindly furnished addresses of makers and other necessary information. I am also indebted to Dr. Paul A. Moody of Burlington, Vermont, for assistance in securing a permit.

Three months were consumed in getting the net made and delivered, and in securing the necessary permits to operate it. The cost was about twelve dollars, including fees for three letters written in Italian. Bats, because of their habit of flying at a considerable distance from the ground, can best be netted near or over streams and ponds as they come to drink. Because of the difficulty of setting and tending the net, work was confined to bats of the genus *Myotis*, and *M. sodalis* was the only species taken.

The net was set and watched over the same period of time each night. A well defined feeding route was regularly followed by the bats, with occasional slight deviations. *Myotis* seemed very adroit at avoiding the net and could in most cases detect it quite readily. The net was set at the top of a four foot woven wire fence at the edge of a group of trees. This brought the top of the net to a distance of ten feet from the ground. Observations may be summarized as follows:

The greatest period of activity seemed to be from 7:45 to 8:45 P.M. during July and August. No bats were taken after 8:45 P.M.

At a temperature of 60°F. or higher the bats flew too high to come in contact with the net. At a temperature of 58°F. or lower the bats flew low enough to come in contact with the net.

Myotis sodalis is capable of gnawing away a sufficient area of net to allow escape when left in all night. Despite the limited number of times the net was used it became apparent that nets will be of great value in connection with bat banding.—F. L. Osgood, *Rutland, Vt.*

MINK DISPLAYS SLIDING HABITS

Recently I had the opportunity of observing signs showing that a mink had made several repeated slides on snow-covered slopes.

The observation was made early on the morning of March 9, 1935, in Dexter Township, near Ann Arbor, Michigan. The ground was covered with two inches of snow; the minimum temperature for the previous twelve hours had been eight degrees Fahrenheit; the skies were clear; and moderate west winds prevailed.

The track of a mink, probably a female, since it was small (hind foot 21 mm.), was found in a sedge marsh bordering a small lake. After killing a mouse near a shallow drainage ditch, the animal had moved to a heavily grazed grassy upland which is severely gullied along its lower margin. Here the tracks showed where the mink had slid on its abdomen eight successive times. Each slide was separate, and extended for distances of from ten to twenty-five feet in one of the short steep "leader" gulleys. To repeat a slide the mink returned to the rim of the gulley by the shortest route possible. After this activity the animal returned to the marsh where it denned up under a tamarack.

Seton (Lives of game animals, vol. 2, pt. 2, p. 530) records a mink that slid in a similar fashion; however, that animal had slid only once as it traveled along its route. I can find no references to repeated slides.—WILLIAM H. MARSHALL, *University of Michigan, Ann Arbor, Mich.*

COUGAR AND COYOTE

My friend, Pyeart Hulse, whose ranch is on Canyon Creek, Middle Fork of the Gila River, New Mexico, writes me about an experience of his father in December while on his trap line. I will tell the story in Pyeart's words: "My Dad had a strange experience with a lion last month. He was out on Canyon Creek Mountain setting some traps when he came right on to a lion and a kitten, and was within a few feet of them before either saw the other. The lion made away at once and jumped into the thick brush, preventing a shot. The lion had killed a deer and on looking it over Dad found a dead coyote a few feet from the kill. The ground was soft from a rain of the previous day and the tracks easy to trace. On looking closely he saw where the coyote had come up to the kill, and there it was that the lion made for the coyote and caught it in a couple of bounds. The coyote's head was badly crushed and showed where the tusks had gone through the skull into the brain, killing the beast at once. Dad set some traps at the deer carcass but the lion did not return. He skinned the coyote."

Evidently these predators were not on such friendly terms as it is supposed they sometimes are.—CHARLES A. GIANINI, *Poland, New York.*

SUPERNUMERARY NIPPLES IN MONKEYS

Two papers on the subject of supernumerary nipples in non-human Primates have recently appeared in this journal (Hartman, 1927, vol. 8, p. 96; Coolidge, 1933, vol. 14, p. 66), and since the question is of some interest, the following additional data relating to it are detailed here.

Papio porcarius, the chacma baboon. On May 4, 1930, fourteen female baboons belonging to one pack were shot near Grahamstown in the Eastern Province of South Africa (Zuckerman, 1931, Proc. Zool. Soc. London, p. 325). Of the twelve adults, three possessed supernumerary nipples situated in the milk line below the normal nipples. The accessory nipples were single in two (M.23 and M.24) and double in the third (M.29), in which they were situated 2½ inches below the normal pair. M.24 and M.29 were pregnant. Milk could be expressed from the normal nipples of M.23 and M.29, who presumably were suckling young at the time they were shot; none could be expressed from any of the supernumerary nipples. Dissection failed to reveal glandular tissue in relation to the accessory nipples of M.29.

The pack to which these fourteen females belonged could not have numbered more than 100, and the presence of three animals with accessory nipples in a random sample of fourteen animals belonging to the group bespeaks a high localized incidence for this anomaly. In Man, according to Hartman, the incidence is about 1 percent. The hereditary nature of the condition in Man has been established; therefore this high incidence within a single baboon pack is suggestive of considerable inbreeding. The social

organization according to which the animals live—harems and troops maintained by masculine dominance (Zuckerman, 1932, The social life of monkeys and apes, London, pp. 233-237)—is undoubtedly conducive to inbreeding.

Macaca nemestrina, the pig-tailed macaque. An accessory nipple was present in a nearly mature female of this species that lived in the Department of Physiology, Yale University School of Medicine. It was situated on the right side, close to the midline, about an inch below and half an inch medial to the normal right nipple. In diameter and height it measured about $\frac{3}{16}$ of an inch, and when the animal's sexual skin was swollen, both the normal and accessory nipples were redder and more erect than at other times.

Macaca mulatta, the rhesus monkey. Supernumerary nipples have been reported in the female of this species. The following instance concerns a young male born in the laboratory of the Department of Obstetrics and Gynaecology of the Yale University School of Medicine. An accessory nipple was present on the left side below and medial to the normal left nipple. The interest of this case lies in the fact that the prominence of this supernumerary nipple increased, and its color became more intense, when the animal was injected with oestrin, the accessory nipple behaving in the same way as did the normal pair, which reacted to the hormone in the manner characteristic of the female of the species.—S. Zuckerman, *Beit Memorial Research Fellow, Department of Human Anatomy, Oxford, England.*

WHAT IS WEE-NÉSKW OF THE LABRADOR INDIANS?

Dr. W. D. Strong in his Notes on the Mammals of the Labrador Interior (Journ. Mamm., vol. 11, no. 1, February, 1930) says, "An animal, which would seem to be the woodchuck, was described by several Indians who had seen it near Northwest River post on Hamilton Inlet. This animal is said to be slightly larger than a muskrat and lives in a burrow, hibernating until March. The Indians called it wee-néskw, and the local whites 'la cole' . . . . (p. 8). From my general knowledge of Algonquian languages and of the particular dialect in question, I am confident that the restoration in simplified standard transcription should be wīnɑskᵘ. Quite obviously this corresponds to Cree wīnɑsk: see Watkins's A Dictionary of the Cree Language, London, 1865, p. 12: "Badger, *n* (small) wenusk (large) mistunusk" and p. 446 "Wenusk, *n. an.* A small badger," as well as p. 277 "Mistunusk, *n. an.* A large badger." Lacombe, however, in his Dictionnaire de la Langue Crise, Montreal, 1874, gives on p. 43 BLAIREAU, *mistanask* and on p. 460 MISTANASK. . . *blaireau.* The phonetic restoration is clearly mistɑnɑsk, and Cree mist- means "big." There are no badgers in the Labrador peninsula; they do occur in a small part of the extreme western territory occupied by Crees; the woodchuck is generally distributed throughout the territories occupied by the Cree and Montagnais: consult the maps on p. 260, vol. II, pt. 1 and on p. 341, vol. IV, pt. 1 of Ernest Thompson Seton's "Lives of Game Animals;" for the distribution of the Cree and Montagnais see the map in the 28th Ann. Rept. B.A.E. Nascapee should be colored the same as Montagnais. Watkins's "small badger" and "large badger" must be local designations.

In footnote 2, p. 245 of vol. 21 of the Publications of the Champlain Society, Toronto, 1934 (which volume contains the Journals of Samuel Hearne and Philip Turner, between the years 1774 and 1792) the editor (J. B. Tyrrell) says, "They ascended the Echimamish river to a small lake known to the Indians as Wenisko (or Groundhog) lake but now designated on the map as Hairy lake." It may be pointed out that G. S. Miller, Jr. was told that wenusk was the Indian name for woodchuck at Nepigon (Proc. Boston Soc. Nat. Hist., April, 1897, p. 27). This solution does no violence to the known distribution of the animal in question.—Truman Michelson, *Bureau of American Ethnology, Smithsonian Institution, Washington, D. C.*

APPARENT SEGREGATION OF SEXES IN FLYING SQUIRRELS

In the course of collecting and studying flying squirrels, *Glaucomus volans volans*, and *G. sabrinus macrotis* near Rutland, Vermont, over a period of three years it became apparent that there was a definite segregation of the sexes at all times, with the exception of the breeding season and a short period while the young are immature. In all cases, with the exception of one during the breeding season and one directly following, it was found that where more than one squirrel occupied the same stub they were all of one sex.

On May 17, 1931, two males of the small species (*volans*) were found in a beech stub. On June 30, 1932, a single *volans* from the same place proved to be a male. On November 28, 1934, two more male *volans* were found occupying the same site.

On March 20, 1932, four females of the large species (*sabrinus*) were taken from one beech stub. Two were later liberated. The other two showed stimulation of the reproductive tract, due no doubt to the approach of the breeding season. They were kept alive until April 15.

On November 30, 1934, four male *volans* were taken from a large tree. Two were adult and two subadult. A single male of the same species was found in a nearby hole. On December 24, 1934, a single male *volans* was found in the home of the four mentioned above. No females were found on this ridge.

On December 26, 1934, two female *macrotis* were found in one nest and two female *volans* in another a short distance away. Both trees were on the opposite side of the valley on a ridge parallel with the one occupied by the six male *volans* mentioned above.

On December 31, 1934, two female *volans* were found occupying a cavity one mile north of the other females but still on the same ridge. A single female was taken December 1, 1934, about midway between these two localities on the same ridge.

This would seem to indicate that a separate range as well as a separate nest cavity is occupied by each sex, at least in winter. Food conditions were identical on both ridges.

A pair of *volans* was found breeding on April 19, 1933. This is the only record for the breeding season. Particular care has been taken not to disturb the squirrels during the breeding season. Four *volans* were found in a tall maple, July 3, 1932; this family consisted of an adult male and female and an immature male and female.

Observations were made at distances varying from three to fifty miles from Rutland. *G. s. macrotis* was found in or near evergreens; *G. v. volans* seemed to be partial to open hardwoods.

While the amount of data accumulated would not warrant any positive statement as to the segregation of the sexes it is hoped that notes, records and future observations of other workers may when assembled and compared give us grounds for a definite conclusion.—F. L. Osgood, *Rutland, Vermont.*

GOLDEN HARVEST MOUSE IN ANDERSON COUNTY, KANSAS

In the fall of 1934, while checking over certain mammal skins in the holdover collection, I discovered a cataloged but unidentified mouse skin that upon examination proved to be a specimen of *Reithrodontomys fulvescens aurantius*, the golden harvest mouse. The skull appears to have been lost with the skeleton, which was prepared at the time the mammal was collected. The specimen, no. 4478 in the University of Kansas collection, was taken in Anderson County, Kansas (no exact locality given, but presumably near Garnett), June 29, 1925, by T. E. White; original number, 120.

Although the skull is missing there is no question as to the identity of the skin, it being exactly like specimens of this form from Oklahoma and Arkansas. The previous known northern limit of this mouse appears to be Carthage, Jasper Co., Missouri, according to the revision of the genus *Reithrodontomys* published in 1914 by A. H. Howell, (North American Fauna no. 36, pp. 48–49). There are also two skins and skulls of this

species in the University of Kansas collection from Cherokee County, Kansas, collected 18 miles west of Columbus, on December 28, 1913 and December 29, 1915, both by Vic. Housholder, which are the only previous Kansas records.—J. D. BLACK, *Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas.*

PORCUPINES KILLED AND EATEN BY A COYOTE

On January 25, 1935, while on ski patrol at Cedar Breaks National Monument, Utah, I discovered convincing evidence that a female coyote had killed and eaten two porcupines within a lapse of less than three hours' time. Believing this to be the first record of such an event, I made detailed notes of the circumstances, which were as follows:

At 11:00 a.m., while observing birds at the edge of a large meadow in a forest of Englemann spruce (10,200 feet elevation), my attention was diverted by a large coyote (*Canis lestes*), which trotted past me about 50 feet distant. I watched the coyote until it had traversed approximately a mile of open snow fields, and then I began to follow it, skiing rapidly over the five-foot snow pack where the coyote often sank in 4 inches. Average distance between the coyote's tracks when walking was 8 inches; when trotting, 22 inches; imprint measurements were: hind foot, $2\frac{1}{2}$ inches wide and 3 inches long; front foot, $2\frac{3}{4}$ inches wide and $2\frac{1}{2}$ inches long.

After trailing for $3\frac{1}{2}$ or 4 miles I came, at 1:30 p.m., to the scene of the first kill. The coyote had picked up the trail of a porcupine, which followed a tortuous course through the trees and brush, and had followed it with apparent caution as shown by the fact that it placed its feet exactly in the porcupine's imprints. After 100 yards of this double trail I came to an area approximately 10 feet in diameter where an apparent struggle between the porcupine and coyote had taken place. The snow within this area was packed down about 6 inches below the surrounding surface and was flecked with blood. Near the center of the snow-packed area was the skin of a porcupine (*Erethizon epixanthum epixanthum*) which retained enough bodily heat to give off a little steam. The skin included only those portions that bear quills, and a thorough search of the area and of the coyote trails which radiated out a short distance in several directions failed to disclose any other traces of the porcupine. However, the claws, skull, etc., might easily have been trampled into the soft deep snow. There was no evidence of a cache having been made.

Porcupine fecal pellets under four white fir trees in close proximity to the site of the conflict showed that the porcupine had spent some time in the vicinity. The dark color and well developed underfur of the porcupine seemed to show the animal to be a juvenile; however, the size of the skin appeared large enough for a porcupine near maturity.

The coyote rolled in the snow 12 feet from the kill; deposited feces and urinated 3 feet farther away, where the tracks indicated that it was a female. The trail then led northeast along the slope. At 2:45 p.m. I found the place of a second kill, approximately one mile from the first. The event and activities here resembled those of the previous affair. In this case the porcupine's jaw bones were found 3 feet from its skin. The coyote defecated 20 feet from the remains of the porcupine and urinated about 100 yards away.

She next continued eastward to the mountain top, where she had scouted around among the basaltic rocks and then lain down. The tracks were very fresh from this point; they led east across the top of the mountain, then down the east side, and indicated that the animal was traveling rapidly.

At 4:30 p.m. I abandoned the trail and returned to camp, about 3 miles distant, crossing 6 coyote trails on the way. Measurements of these showed three different sizes. Feces of one coyote (an animal smaller than the one I followed) had 8 porcupine quills embedded in them.—L. FLOYD KELLER, *Resident Wildlife Technician, Wildlife Division, U. S. National Park Service, Zion National Park, Utah.*

THE PROPER USE OF THE GENERIC NAME NESTORITHERIUM

The genus *Nestoritherium* was founded by Kaup in 1859, in his "Beiträge zur näheren Kentniss der urweltlichen Säugethiere," Heft 4, p. iv. It was based on *Chalicotherium sivalense* (Falconer and Cautley).

In Hugh Falconer's "Palaeontological Memoirs," vol. 1, p. 223, there is a statement regarding *Nestoritherium* that has led to a considerable amount of confusion among students of the Chalicotherioidea. Falconer's remarks are quoted below.

"*Chalicotherium*. Munich, June 15, 1861.—Most interesting of all the Pikermi collection are a set of specimens of a very large species of the same *genus* as our Sewalik *Chalicotherium*. This is the *Nestoritherium*, Kaup (Beiträge, viertes Heft. 1859), which is figured and described by Wagner (1857) under the name of *Rhinoceros pachygnathus*."

This statement by Falconer led Holland and Peterson (Mem. Carnegie Mus., vol. 3, no. 2, p. 207, 1914) to suppose that *Nestoritherium* was founded on one of several specimens, described by Wagner as *Rhinoceros pachygnathus*. Since the specimen figured by Wagner happens to be identical with *Ancylotherium pentelici* (Gaudry and Lartet), Holland and Peterson concluded that the type of *Nestoritherium* must be the species from Pikermi. They write: "From the foregoing it is seen that the generic name *Nestoritherium* has priority over *Ancylotherium*, the type species being *pachygnathum* Wagner, a homonym, which must be dropped according to the laws of nomenclature, and replaced by *pentelicum* Gaudry et Lartet, which is identical, and also has priority."

Holland and Peterson created a new genus, *Circotherium*, for the reception of the Siwalik species, *Chalicotherium sivalense*.

Dr. Matthew (Bull. Amer. Mus. Nat. Hist., vol. 56, pp. 516–517, 1929) concluded that *Nestoritherium* was founded either on the species *Rhinoceros pachygnathus* Wagner (in which case it would be a rhinoceros and not a chalicothere), or on one certain specimen figured by Wagner as *Rhinoceros pachygnathus*. In the latter case, according to Matthew *Nestoritherium* would be based on a *"species innominata"* of Kaup.

Matthew, like Holland and Peterson, made the mistake of supposing that *Rhinoceros pachygnathus* is the type of *Nestoritherium*, in spite of the fact that Palmer in his Index Generum Mammalium, 1904, had correctly designated *Chalicotherium sivalense* as the type.

I recently wrote to Dr. A. Tindall Hopwood of the British Museum for help on this problem, because he had access not only to Kaup's "Beiträge," but also to the collections and notes of Dr. Falconer. I take the liberty of quoting from his letter.

"I have waded through Kaup's somewhat confusing account of *Nestoritherium* without finding a single mention of Wagner, or of Wagner's rhinoceros, but a very definite reference to *Chalicotherium sivalensis* Falc. & Caut. There is no doubt that this species is the genotype of *Nestoritherium;* Kaup confirms this in his introduction to Heft IV, for on p. iv he speaks of the 'Indian genus *Nestoritherium*.' "

From the above it is clear that *Nestoritherium* Kaup, 1859, is based on *Chalicotherium sivalense* (Falconer and Cautley) and that the name *Circotherium* Holland and Peterson, 1914, is a synonym. The Pikermi species is properly referable to the genus *Ancylotherium* Gaudry, 1863.

The name *Nestoritherium* is incorrectly used by the following authors:

Falconer, Hugh. 1868. Palaeontological Memoirs and Notes, vol. 1, pp. lvi + 590; vol. 2, pp. xiii + 675.

Holland, W. J., and O. A. Peterson, 1914. Osteology of the Chalicotheroidea. Mem. Carnegie Mus., vol. 3, no. 2, 189–406, pls. 48–77.

Zittel, K. A. von. 1925. Textbook of Palaeontology. (Revised edition.) Macmillan.

Matthew, W. D. 1929. Critical observations from Siwalik mammals. Bull. Amer. Mus. Nat. Hist., vol. 56, art. 7, pp. 437–560. February 9, 1929.

Colbert, E. H. 1934. Chalicotheres from Mongolia and China in the American Museum. Bull. Amer. Mus. Nat. Hist., vol. 67, art. 8, pp. 353–387, fig. 15. November 7, 1934.

—EDWIN H. COLBERT, *American Museum of Natural History, New York, N. Y.*

BLACKFISH IN THE GULF OF ST. LAWRENCE

A school of blackfish (*Globicephala melaena*) was stranded in the Gulf of St. Lawrence, between Metis and Matane, on September 6, 1934. I counted 23 dead at Metis and 3 at Tartague and Riviere Blanche. Gordon Astle said 40 were taken about Boule Rock sand bank and 5 or more about Tartague. The animals ranged from 6 to 20 feet in length. A male measuring 14 feet in length was estimated to weigh 1,500 pounds.

About 2,000 pounds of the meat from the Boule Rock catch was placed in cold storage at Matane. It was used for fox food by the Prince Edward Island fox farmers, and was found to be excellent for the purpose.—S. J. MATHEWSON, *Montreal, Quebec.*

SEVENTEENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS

The seventeenth annual meeting of the American Society of Mammalogists was held at the Carnegie Museum, Pittsburgh, Pennsylvania, from April 30 to May 4, 1935. There were 71 members present, representing 13 states and two Canadian provinces.

PROGRAM

TUESDAY, APRIL 30

8:00 *p.m.*

Meeting of the Board of Directors at the Hotel Schenley

WEDNESDAY, MAY 1

9:00 *a.m.*

Address of welcome. Andrey Avinoff, Director, Carnegie Museum.

1. The type localities of some Mexican mammals. W. H. Burt.
   Discussed by V. Bailey.
2. Remarks on the nomenclature of *Perognathus*. Seth B. Benson.
   Discussed by V. Bailey.
3. Recent activities of the American committee for international wild life protection. Harold J. Coolidge, Jr.
   Discussed by M. W. Lyon, Jr., H. H. T. Jackson, W. B. Scott, R. Kellogg, J. M. Phillips, A. Avinoff, and H. E. Anthony.
4. Wildlife work under E. C. W. in the National Parks and Monuments. Victor H. Cahalane, Adolph Murie, Adrey E. Borell, and E. Lowell Sumner, Jr. (Read by Victor H. Cahalane.)
   Discussed by L. R. Dice, G. M. Wright, M. W. Lyon, Jr., W. S. Schmitt, W. H. Wright, C. C. Adams, V. Bailey, H. H. T. Jackson, F. Harper, and Elisabeth Hone.

2:00 *p.m.*

5. Porcupines killed and eaten by a coyote. L. Floyd Keller. (Read by G. M. Wright.)
   Discussed by V. Bailey and W. Bebb.
6. Demonstration of a live trap for small mammals. Seth B. Benson.
   Discussed by C. C. Sanborn and W. J. Hamilton, Jr.

7. Life history notes on the raccoon. W. J. Hamilton, Jr.
   Discussed by M. W. Lyon, Jr., W. Bebb, and A. R. Shadle.
8. The behavior of animals during a total solar eclipse. Harold J. Coolidge, Jr.
   Discussed by H. Zahniser, D. R. Griffin, R. M. Anderson, and S. B. Benson.
9. Notes on the life history of *Sigmodon*. Seth B. Benson.
   Discussed by V. Bailey.
10. Sea elephants, sea lions, and the capture of a porpoise. Motion pictures by W. Chas. Swett, *Hancock Pacific Expeditions*. (Shown by Waldo L. Schmitt.)

3:30 *p.m.*

Annual Business Meeting of the Society

8:15 *p.m.*

11. History of the cats in the Americas. William Berryman Scott.

THURSDAY, MAY 2

9:00 *a.m.*

12. The primary groups of *Rattus* in the East Indies, and their distribution. G. H. H. Tate.
    Discussed by M. W. Lyon, Jr.
13. Habits and distribution of the American Arctic hares. Arthur H. Howell.
    Discussed by R. M. Anderson and M. W. Lyon, Jr.
14. A note on *Geomys bursarius illinoensis* Komarek and Spencer, in Indiana. Frederick H. Test.
    Discussed by W. Bebb, M. W. Lyon, Jr., and A. H. Howell.
15. Plain and plateau mammals of northeastern Ohio. B. P. Bole, Jr.
    Discussed by A. H. Howell, M. W. Lyon, Jr., D. R. Griffin, and W. J. Hamilton, Jr.
16. The Sonoran biotic province. Lee R. Dice.
    Discussed by W. Bebb and V. Bailey.
17. The taxonomic significance of the baculum (*os priapi*) in certain rodents. W. H. Burt.
    Discussed by W. B. Scott, M. W. Lyon, and A. H. Howell.
18. Wildlife work under the State Park Emergency Conservation Work. George Baggley. (Read by G. M. Wright.)
    Discussed by M. W. Lyon, Jr., Rosalie Edge, W. C. Henderson, B. Campbell, W. E. Saunders, A. R. Shadle, and J. M. Phillips.
19. Some problems of mammal distribution in southern British Columbia. R. M. Anderson.
20. Rocky Mountain mammals. (Moving pictures.) Wendell and Lucie Chapman.
    Discussed by V. Bailey.
21. A preliminary study of the bighorn of Yellowstone National Park. Harlow B. Mills. (Read by G. M. Wright.)

2:00 *p.m.*

Final Business Meeting of the Society

3:00 *p.m.*

22. Status of the bighorn in Death Valley National Monument. Victor H. Cahalane.
    Discussed by B. P. Bole, Jr.
23. Some proposed National Parks in relation to conservation of local mammals. George M. Wright.
    Discussed by L. R. Dice, O. J. Murie, C. C. Adams, and M. W. Lyon, Jr.

7:00 *p.m.*

The annual dinner of the Society was held at the Hotel Schenley. After the dinner, which was held in conjunction with the American Society of Ichthyologists and Herpetologists, Dean Sage, Jr. gave an illustrated lecture, "Hunting Trails of Far West China." This lecture was followed by films of animals of the Rocky Mountains with an accompanying lecture, "Rocky Mountain Mammals," by Mrs. Lucie Chapman.

FRIDAY, MAY 3

9:00 *a.m.*

24. The oral mucosa of edentulous spaces in man and some lower mammals. W. H. Wright and H. H. Collins.
    Discussed by M. W. Lyon, Jr.
25. A search for William Bartram's buffalo lick. Francis Harper.
26. A study of the bone gnawing habits of rodents. William Bebb.
    Discussed by L. Chapman, A. R. Shadle, A. B. Howell, M. W. Lyon, Jr., and B. Campbell.
27. Some intra-specific studies of *Microtus pennsylvanicus*. Olive L. Bown.
    Discussed by L. R. Dice, M. W. Lyon, Jr., and W. Bebb.
28. Federal duty toward wildlife conservation. J. N. Darling. (Read by W. C. Henderson.)
    Discussed by L. R. Dice, H. H. T. Jackson, M. W. Lyon, Jr., H. E. Anthony, A. B. Howell, V. Bailey, J. M. Phillips, C. C. Adams, R. M. Anderson, C. C. Sanborn, S. B. Benson, G. M. Wright, and W. E. Saunders.

1:00 *p.m.*

29. Anomalies in brain development resulting from removal of skull bones in young rats. M. H. Green and H. H. Collins.
    Discussed by B. Campbell.
30. Myological specializations of the ungulates. Berry Campbell.
    Discussed by M. H. Green.
31. The swimming mechanism of the platypus. A. B. Howell.
32. Strange doings in beaver land. A film supplied by National Parks of Canada, Dept. of Interior. (Shown by R. M. Anderson.)
33. Inheritance of subspecific characters in the deer-mouse, *Peromyscus maniculatus*. Lee. R. Dice.
34. Some recent accomplishments in mammalogy. H. H. T. Jackson.
35. Extrusive growth and attrition of incisors in albino and hybrid *Rattus norvegicus*. Albert R. Shadle, Laverne G. Wagner, and Theodore Jacobs.
    Discussed by H. J. Coolidge, Jr., A. J. Poole, M. W. Lyon, Jr., C. C. Adams, V. Bailey, A. B. Howell, W. J. Hamilton, Jr., R. Kellogg, H. H. T. Jackson, E. A. Preble, R. M. Anderson, and R. T. Hatt.

8:15 *p.m.*

The members of the Society were entertained at a smoker held in the Museum Cafeteria and given by the Carnegie Museum. Dr. Andrey Avinoff, Director, Carnegie Museum, gave a short illustrated address "On Mammal Portraiture, or From Cave Dweller 'till Futurist."

SATURDAY, MAY 4

9:00 *a.m.*

Members were the guests of the Pittsburgh Zoological Society on an escorted tour of the Homestead Steel Mill.

At the meeting of the Directors on April 30, the chairman of the editorial board

presented his resignation and other members of the editorial board expressed their willingness to be relieved. The resignations were accepted and by unanimous vote the chairman and members of the board were thanked for their excellent services.

At the annual business meeting the election of officers resulted as follows: president, H. E. Anthony; vice-presidents, Edward A. Preble and Joseph Grinnell; recording secretary, Robert K. Enders; corresponding secretary, William H. Burt; treasurer, Mrs. Viola S. Snyder; editor, A. Brazier Howell. Directors for 1935–1937 were elected as follows: Remington Kellogg, A. Brazier Howell, W. E. Saunders, Harold J. Coolidge, Jr., William J. Hamilton, Jr.

The following summary of membership and subscription conditions was presented:

New members elected at current meeting	54
New subscriptions received since last meeting	40
Total gross additions to the mailing list of the Journal	94
Resignations since last meeting	18
Deaths reported	13
Number delinquent in dues two years	37
Number delinquent in dues one year	79
Number of honorary members	3
Number of life members	58
Number of annual members	712
Total number of members	770
Number of subscribers	163
Total present mailing list	812

The corresponding secretary pointed out that there were certain changes which showed an encouraging trend for the Society. The mailing list has again shown an increase, a few more new members were obtained than in the previous two years, the number of new subscriptions was higher than in any previous year in the Society's history, and resignations were fewer than at any time since 1926. He also expressed his belief that the present membership was reasonably stable.

Of the thirteen members whose deaths were reported six were charter (*) members. The thirteen were: Mrs. F. T. Bicknell, *E. J. Brown, *W. L. Burnett, Hal. G. Evarts, Harold Herrick, G. Carl Huber, *George E. Johnson, *Edward W. Nelson, *George D. Pratt, William M. Savin, William J. Sinclair, *W. P. Stark, J. M. Wainwright.

Reports of progress by the Committee on Life Histories and Ecology, and the Committee on Conservation of Land Mammals were read and adopted.

REPORT OF THE COMMITTEE ON THE CONSERVATION OF LAND MAMMALS

During the past year your committee on Conservation of Land Mammals carried on rather an extensive correspondence, attended several annual meetings of organizations dealing with conservation, and made limited observations in the field.

It has appeared to your chairman that the year gone by and the years immediately in prospect are more fraught with potential disaster to many species of mammals than any similar period of which we have a record. The culmination of a long era of overgrazing on the public domain, the destruction of watersheds, the draining of marsh lands, and more recently the sustained annual droughts of continental extent, attended by dust storms, forest fires, et cetera, have all laid a heavy tax upon wildlife. Nature, left to herself, is taking a heavy toll of many species, but the local projects of countless relief activities, well-meant though most of them may be, bring into the picture additional forces of destruction. Pressure is brought to bear to launch extermination campaigns against rodents as a means of putting men to work; counties hitherto without a conscious need of mammal control discover that neighboring counties have received

funds for this type of work and hasten to claim their share; zealous but untrained local personnel fight the mosquitoes in a marsh by draining, firing the grass, or oiling, and sweep away with the insects all of the highly specialized swamp fauna.

At no other time in our history has there been such a heavy concentration of personnel on the public domain, in our national forests, in the national parks, and in the very choicest of our wilderness areas. From a multitude of sources come plans to alter or to improve wild lands. We are in a period of experimentation with social values; and one of the laboratories for trying out these experiments is the great out-of-doors. It is inevitable that such a concentration of men will react strongly upon any primitive environment they enter.

It would seem to your committee that the most important duty now devolving upon conservationists is to call attention to the issues at stake and to ask for a full consideration of wildlife in every large-scale operation whether County, State or Federal, before large sums of money or masses of men are set to work upon the public domain. If a non-partisan organization such as the National Resources Board can delegate competent advisers to review all plans affecting wild lands, and, if the final decisions can be reached without concessions to politics, special interests, or expediency, much of the menace to our fauna may be nipped in the bud.

The most important activities of your committee since the last annual meeting include the following:

Attendance at annual meetings of Federal Elk Commission and American Game Association. Two conferences on mosquito control campaigns in relation to wildlife.

Brief field observations in Yellowstone National Park and Jackson Hole relative to elk problem.

Letters to United States Senators and to President Roosevelt about the bill to remove protection from Steller sea-lions.

Contact with National Resources Board to ask for every consideration for wildlife in large-scale operations involving the public domain.

Correspondence with National Park Service about the northern Yellowstone elk herd; and about boundaries for proposed Mount Olympus National Park.

General circulization of Relief Organizations about projected control campaigns in Arizona, Arkansas, California, Colorado, Idaho, Illinois, Iowa, Maine, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, Wyoming, and Alaska.

Outline of our stand on control campaigns, in reply to request from Associate Consultant, South Dakota, National Resources Board.

Correspondence with trappers and members of the fur trade regarding their attitude toward control operations.

Correspondence about killing of mammals during rabies outbreak in Maine.

Correspondence and conferences to secure support for three proposed new national park projects—the Mount Olympus, the Kings Canyon, and the Big Bend National Parks.

Correspondence on setting aside of Admiralty Island as a wild life sanctuary.

Respectfully submitted,

H. E. Anthony, *Chairman*
Lee R. Dice
Madison Grant
Joseph Grinnell
T. S. Palmer

The Resolutions Committee offered 14 resolutions which were adopted at the final business session of the Society and referred to the Editorial Committee for consideration and publication in the Journal of Mammalogy.

WHEREAS, Civilian Conservation Camps have been established in National and State Parks on a large scale, and

WHEREAS, these Camps have often lacked adequate technical supervision of their members in relation to wild life and natural resources, with the result that much serious damage to natural conditions has resulted,

Therefore Be it Resolved, That the American Society of Mammalogists at its seventeenth annual meeting in Pittsburgh in May, 1935, urges that the numbers of those camps should be reduced in both National and State Parks and particularly in all parks where adequate supervision can not be provided.

WHEREAS, the Jackson Hole region of Wyoming constitutes one of the finest recreational and wildlife areas in the United States, and

WHEREAS, The Jackson Hole elk herd, which has attracted national attention and is at present the largest remaining herd of elk in the world, and,

WHEREAS, under present conditions, that portion of the herd which regularly migrates to Jackson Valley for the winter finds insufficient lowland winter range and must be artificially fed, and,

WHEREAS, it has come to our attention that conflict with ranching interests has recently become acute,

Now, therefore, Be it Resolved, That the American Society of Mammalogists at its seventeenth annual meeting in Pittsburgh in May, 1935, urges that the Wyoming Congressional Delegation be requested to initiate legislation necessary to obtain by purchase suitable lands for public ownership in Jackson Valley to properly care for this splendid elk herd.

WHEREAS, experience has shown that domestic reindeer and wild caribou cannot occupy the same range, since in such cases the caribou are inevitably eliminated, and

WHEREAS, a few years ago a herd of about 2000 reindeer was driven from the Kuskoquim River through Mt. McKinley National Park and many of these strayed among the wild caribou and eventually the entire herd of reindeer mingled with these caribou, so that in subsequent years reindeer and hybrids have been frequently observed in the Mt. McKinley National Park, and

WHEREAS, similar mixture of domestic reindeer and caribou resulted from the recent reindeer drive from Bering Sea to the Mackenzie River, and

WHEREAS, reported overgrazing on the reindeer ranges of Bering Sea and reported abandonment of much of the reindeer herding in this area, which appears to be taking place or to be imminent, may result in the moving eastward of the reindeer to better grazing in the caribou country,

Now, therefore, Be it Resolved, That the American Society of Mammalogists at its seventeenth annual meeting in Pittsburgh in May, 1935, urges that the proper authorities entrusted with the administration of the reindeer industry and with the protection of the Alaskan caribou be urged to take the proper steps to safeguard the ranges of the wild caribou from encroachment of stray domestic reindeer, to carefully designate the areas to be occupied by each and if necessary to eliminate the reindeer not under complete control of herders.

WHEREAS, the American Committee for International Wild Life Protection has submitted the following resolution for the indorsement and support of the American Society of Mammalogists, and

WHEREAS this resolution is to be submitted to Natural History Museums, Zoological Societies, Conservation and Sportsmen's Organizations in the United States that have an interest in preserving the wild life of foreign countries and especially in preserving rare species

Therefore Be it Resolved, That the American Society of Mammalogists at its seventeenth annual meeting in Pittsburgh in May 1935 endorses and pledges its support to the resolution submitted by the American Committee for International Wild Life Protection and worded as follows:

"Under progressive exploitation of natural resources throughout the earth pressure on many interesting species has been such as to bring alarming reduction in numbers or even extermination in numerous forms both of animals and plants.

In view of this, while it is important that representatives of the fauna and flora of the world should be preserved in museums, zoological gardens and arboretums for scientific study, in future specimens of the rarer species need to be obtained with discretion in order that collecting in the name of science may not lead to actual extermination.

It is urged that organizations and private collectors agree to carry on zoological exploration, collecting and purchases of specimens in such a manner as not to injure or endanger the continued existence of any form. We ask the assent and cooperation of all interested agencies in this important matter."

WHEREAS, there is great need for a law designating some Central Federal Board or Agency through which all transplants of our native mammals must be cleared, and

WHEREAS, unless this is done national parks and other sanctuaries for the preservation of primitive conditions will remain as they are today defenseless against the encroachment of non-endemic forms introduced on lands adjacent to their borders,

Therefore Be it Resolved, That the American Society of Mammalogists at its seventeenth annual meeting in Pittsburgh in May, 1935, urges that such a Federal Board, or some existing agency such as the Bureau of Biological Survey of United States Department of Agriculture be given authority to approve of any such interstate transplants and to issue permits therefore.

Be it further resolved, That competent State agencies should be required to approve of similar introductions within the various states.

Resolved, That the American Society of Mammalogists in session at its seventeenth annual meeting in Pittsburgh, May 3, 1935, expresses its deep appreciation and thanks to the Local Committee on Arrangements, to Dr. Avinoff, Director, and to the Carnegie Museum for the many courtesies and facilities extended and the splendid program which has made this a memorable annual meeting.

In addition to the above, the Society adopted resolutions substantially as follows:

(a) Extending its enthusiastic support to the proposal submitted by Dr. Glover M. Allen for preparing a new list of Recent mammals, bringing Trouessart's list up to date; Dr. Allen was appointed chairman of a special committee to undertake the work, with authority to select the other members of the committee.

(b) Urging the preparation of lists of type specimens preserved in the collections of public institutions.

(c) Recommending to the Federal work agencies having charge of Emergency Conservation Work the employment of trained men to do advance planning on areas where conservation work is to be undertaken; and the employment of a sufficient number of men trained in wild life work to supervise properly the work projects connected with the conservation of native animals and plants.

(d) Urging the establishment in Texas of the proposed Big Bend National Park or Monument (U. S. Senate Bill 2131 and H. R. Bill 6373), for the preservation of jaguar and ocelot, of virgin forest and semiarid desert vegetation.

(e) Urging the establishment in Washington of Mount Olympus National Park or Monument (H. R. Bill 7086) for the preservation of the primaeval state of the mountains, glaciers, forests, and herd of Roosevelt elk.

(f) Urging the establishment in California of the proposed King's Canyon National Park or Monument (U. S. Senate Bill 2289) for the preservation of a superlative scenic area and the wild life contained therein.

(g) Recommending that authority for designation as National Wards certain rare mammals, birds, etc., as for example the grizzly bear, the Florida manatee, and the trumpeter swan, be enacted by Congress of the United States.

(h) Urging that the operation of motor boats be prohibited on the Pymatuning Reservoir Project located on the western border of Pennsylvania and eastern border of Ohio.

An invitation extended by the Academy of Natural Sciences of Philadelphia to hold the annual meeting of 1936 at Philadelphia was unanimously accepted and the determination of the exact time of the meeting was left in the hands of the Local Committee.

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COMMENT AND NEWS

ACTIVITIES OF THE AMERICAN COMMITTEE FOR INTERNATIONAL WILD LIFE PROTECTION DURING 1934–35

Report for the American Society of Mammalogists' Annual Meeting, May 1, 1935

The American Committee for International Wild Life Protection is now in its sixth year. For those who might be interested in the work of the committee, we have published a short history entitled "The First Five Years," which can be obtained by writing to the office at Cambridge, Mass.

We have during the past year elected Mr. Edward House to our Advisory Board as the official representative of the Carnegie Museum. The National Association of Audubon Societies has been elected to membership with Kermit Roosevelt as its official representative.

The committee's office has continued on an active basis, and has brought out two additional publications during the past year. The first is a report entitled "Migratory Bird Protection in North America," a 38 page history of control by the United States Federal Government and a sketch of the treaty with Great Britain. The report was prepared by our chairman, Dr. John C. Phillips. Our second publication was a memoir size report of 87 pages on "The Present Status of the Muskox," with two maps and a detailed bibliography. This publication was the result of over two years of research by our assistant secretary, Miss Elisabeth Hone, a niece of Florence M. Bailey, and was greatly helped by the cooperation received from the Department of the Interior of Canada. The distribution of this report has brought in a flood of letters of appreciation.

We now have ready for press a report with a new up-to-date map of all African Reserves, and with it the complete text of the London Convention, with an explanatory paragraph and pictures to accompany each of the forty-three names of mammals, birds and plants that are listed in the schedule for special protection accompanying the treaty.

Our budget for the current year was enlarged at the time of our annual meeting last December, and we have been able to send contributions of $500 to the International Office at Brussels and $250 to the Society for the Preservation of the Fauna of the Empire.

I am pleased to report to you that we have just received word of the official ratification of the London Convention on African Wild Life Protection by the Governments of Great Britain and Egypt. Only two more ratifications are needed to make this treaty effective. There have recently been many changes in the status of African wild life.

Probably as a result of the London Conference, the government of French Equatorial Africa has created two national parks situated in the Tchad and Oubangui Chari regions. It has also placed the Black Rhino on their list of absolutely protected species. This means that the Black Rhino is completely protected both in the Belgian Congo and in French Equatorial Africa.

The Belgian Government has recently organized what is known as the Institut des Parcs Nationaux du Congo Belge which has complete control of all the reserves and parks of the Congo that may be set aside for the protection of flora and fauna. They also have complete control of scientific research in these areas, and of any tourist travel that they may allow there. This Institute is administered by a commission of at least 24 members, one third named directly by the king, one third named by the king as representatives of specified Belgian Scientific Institutions, the final third to be selected with royal approval from representatives of foreign scientific organizations nominated by the rest of the commission. The commission reports each year to the Minister of the Colonies on its activities and on their results. The forming of this institute is splendid news for all those interested in doing scientific work in the Belgian Congo, and at the same time, it promises to be of great benefit to the parks of the Congo. This is especially true as the present king takes a great personal interest in these matters, and Dr. Van Straelen, the able director of the Natural History Museum at Brussels, is the first President of the Commission.

The Belgian Government has recently announced the formation of a new complete game reserve. This is the Lualaba Reserve between the Lualaba River and the Lufira. It has an area of about 125 thousand square miles, twice as large as the present Parc National Albert. The government has also established another National Park (in the mandate Ruanda-Urandi) known as the Kagera National Park with an area of about 48 thousand square miles. We also anticipate in the near future the creation of a new National Park in the Semliki-Ruwenzori region on the Uganda border.

Last summer Dr. Barbour of our committee made a tour through South Africa, gathering first hand information on the game situation there. He spent a week in the Kruger National Park and discussed with influential people the possibilities of enlarging the Park to furnish badly needed new grazing lands. We received word from high authority that within the last month, the South African Parliament has passed an act providing for a great extension of the Park by several thousand morgens and removing the natives on one of the borders to some other land further away. We also learn from information supplied by Dr. Barbour and Herbert Lang that the South African White Rhinoceros, now only found in a Zululand Reserve, may exceed 200 in number as compared with previous estimates of under 50. The Blesbok and Springbok exist in actually protected conditions only in the Sommervile Reserve in Orange Free State. This is a provincial Reserve that can be wiped out anytime by the stroke of a pen. The White-tailed Gnus enjoy no other protection than that granted by a few rich farmers, one herd having recently been depleted by droughts from 500 to 20. The Bontebok have increased in their Reserve from 17 to 44 since it was proclaimed in 1931. Some 40 Vaal Rhebok are also in this Reserve. There are now 16 Addobush Elephant in the Reserve established for their protection. No new increase is reported. Lang says there must be still about a hundred Mountain Zebras in various places in spite of reports to the contrary. These should increase rapidly if given a good opportunity. There is also a great need for nationalization of the Zululand Reserves, but many political obstacles seem to stand in the way.

The activities of the American Committee are extremely varied. We made a study of the possibilities of a Nature Reserve in the Galapagos Islands. As a result of this, the committee passed a resolution endorsing the wording of the proposed "Scientific Station of the Galapagos Islands Act," proposed by Mr. Egas, the former Ecuador consul in Los Angeles. The committee's resolution further stated that "We are joining with

other scientific institutions throughout the world in recommending to the Government of the Republic of Ecuador the creation of certain Reservations (Asilos Reservados) in the Galapagos Islands, and the preservation of the rare zoological species, which exist only in this archipelago and which have been made famous by the visit of Charles Darwin."

At the request of our committee, Dr. Frank Chapman of the American Museum of Natural History prepared a complete answer to the charges made in foreign countries against the collecting in New Zealand waters carried on by the Whitney South Sea Expedition in 1925 and 1926. This was published in Science, January 25 of this year, and this report, we are confident, will put a complete end to misunderstanding in these matters.

Our committee wishes to call the attention of those interested in problems of wild life protection, to the two excellent papers by Dr. Anderson of the National Museum of Canada. These were prepared for the Fifth Pan Pacific Science Congress on "The Effect of the Introduction of Exotic Animal Forms" and "The Distribution, Abundance and Economic Importance of the Game and Fur Bearing Mammals of Western North America." We also have found of particular interest the careful studies with excellent maps prepared by Dr. Townsend, Director of the New York Aquarium and published by the New York Zoological Society, on the distribution of certain Whales as shown by the log-book records of American Whaleships.

At this year's meeting of the American Committee, we adopted the following resolution, in support of which in some form we shortly hope to obtain the endorsement of the leading Museums, Zoological Societies, Conservation and Sportsman's Organizations that have an interest in the wild life of foreign countries. The resolution reads:

"Under progressive exploitation of natural resources throughout the earth pressure on many interesting species has been such as to bring alarming reduction in numbers or even extermination to numerous forms both of animals and plants.

In view of this, while it is important that representatives of the fauna and flora of the world should be preserved in museums, zoological gardens and arboretums for scientific study, in future specimens of the rarer species need to be obtained with discretion in order that collecting in the name of science may not lead to actual extermination.

It is urged that organizations and private collectors agree to carry on zoological exploration, collecting and purchases of specimens in such a manner as not to injure or endanger the continued existence of any form. We ask the assent and cooperation of all interested agencies in this important matter."

If we are to succeed in promoting the cause of International Wild Life Protection, we must have the full cooperation and support of our member organizations and this particularly applies to the American Society of Mammalogists.

Respectfully submitted,

HAROLD J. COOLIDGE, JR.

THE INTERNATIONAL OFFICE FOR THE PROTECTION OF NATURE

The Belgian Government has by Royal Decree officially recognized the International Office for the protection of Nature and has appointed the following delegates to be its representatives in the General Council of the office:

Delegates for Belgium:

Baron E. de Cartier de Marchienne, Belgian Ambassador in London, and

Count Henry Carton de Wiart, former Prime Minister.

Delegates for the Belgian Congo and the Mandated Territory of Ruanda-Urundi:

P. Charles, Minister of Colonies, and

Professor Dr. V. Van Straelen, Director of the Royal Belgian Museum of Natural History and President of the Institute for National Parks in the Belgian Congo.

MEMBERSHIP

Anyone interested in any phase of mammalogy is eligible for membership in the American Society of Mammalogists, and if elected will receive the Society's official publication, the Journal of Mammalogy, quarterly. Name and address, with remittance of $3.00 for annual dues, may be sent to the Corresponding Secretary, or to any officer of the Society. Membership is dated from the nearest January, although formal election will not take place until the annnal meeting of the Society following the receipt of application.

Back volumes of the Journal of Mammalogy *are still available as follows:*

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William H. Burt, *Corresponding Secretary*
Museum of Zoology, University of Michigan, Ann Arbor, Mich.

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